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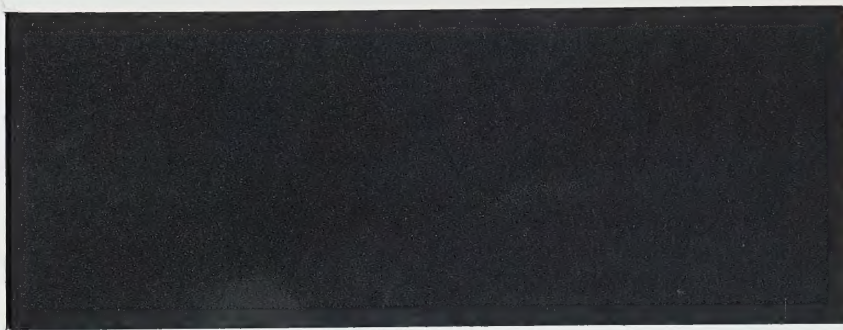
Transportation
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Energy Branch

Publications Catalogue



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Transportation
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Publications Catalogue

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Certain reports have been excluded: reports that are extremely outdated, internal, or have been superseded by later reports.

Videos produced by the branch are also included in this catalogue.

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TRANSPORTATION TECHNOLOGY AND ENERGY BRANCH

Of the many factors influencing our nation's economic well-being and growth, technology and energy have come to the forefront in the past decade. This is particularly true in transportation, where they are vital to future progress and development.

Since transportation is very energy dependent, it is necessary to use existing resources wisely and to develop alternative fuels. Similarly, transportation relies on the application of new technology in areas such as vehicle development and improvement, and rail and transit control.

The Transportation Technology and Energy Branch (TT&E) was established as the provincial government's focus for research and development in transportation technology and energy areas that will lead to new and improved products and services. TT&E both initiates and investigates such developments and advises the ministry on their strategic impact.

The branch's expertise, resource material, and research facilities are available for projects that will increase transportation efficiency and stimulate economic growth in Ontario and Canada. By assisting the transportation industry, TT&E expects to stimulate job creation, investment activity, and Ontario's export potential in the transportation sector.

TT&E operates through six offices and a service section, whose activities are co-ordinated to meet the branch's mandate:

- Vehicle Technology Office
- Rail and Advanced Transportation Systems Office
- Transportation Control Technology and Systems Office
- Traffic and Decision Systems Office
- Transportation Energy and Productivity Office
- Transportation Industry Support
- Administration and Technical Publications Section

For more information about this branch, please contact:

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Vehicle Technology Office

This office conducts and promotes research, development, and demonstrations for commercial and electric vehicles, alternative fuels, and transportation for disabled persons. Components such as tires, air brake systems, and converter dollies, and axles for commercial or heavy vehicles are evaluated and tested for their effects on vehicle handling and stability. Electric vehicle projects include a joint industry/government program to evaluate electric vans to demonstrate their in-service reliability and economy. As well, transit vehicles incorporating advanced electric propulsion systems are studied.

In co-operation with industry, universities, and research foundations, a program for alternative fuels research, development, and demonstration was initiated to encourage and facilitate the introduction of propane, natural gas, and methanol fuels in Ontario. Engines for heavy-duty vehicles have been developed and introduced to demonstrate the economical use of propane and natural gas in transit and highway operations.

Rail and Advanced Transportation Systems Office

This office conducts and manages research, development, and demonstrations in rail transportation technology. The office also conducts systems studies to assess technical, economic, and operational aspects of alternative systems, technologies, and approaches.

The activities of the office pertain to various forms of urban rapid transit systems, regional and high speed rail, and a number of related technologies. Areas of work include suspension systems, track, propulsion, on-board communications and control, computer simulations, testing, noise and vibration, electrification, and assessment of technologies.

Transportation Control Technology and Systems Office

The Transportation Control Technology and Systems Office is responsible for control and communications systems research and development. The aim is to develop solutions that improve the safety, productivity, and efficiency of our transportation systems. Current activities include:

- Automatic Vehicle Location and Control (AVLC) systems for transit
- Automatic scheduling and dispatching for para-transit systems
- Intelligent Vehicle Highway Systems (IVHS) projects including:
 - integrated traffic data management
 - driver route guidance systems
 - emergency vehicle location
 - wide area vehicle monitoring (WAVM)
 - automatic vehicle identification (AVI) for trucking
- Automated maintenance robotics.

The office works closely with the transportation industry to identify needs and to tailor solutions to meet those needs.

Traffic and Decision Systems Office

The Traffic and Decision Systems Office (TDSO) is responsible for traffic research in the ministry. The goal is to improve traffic flow and safety on our highways and urban road networks, and reduce energy consumption and air pollution. Present activities include:

- developing improved traffic management and driver information systems for freeway corridors and urban street networks by applying the latest development in computers, communications, and related technologies.
- developing new traffic flow models, simulations and other support tools to aid in the planning and design of new traffic management systems.
- engaging in co-operative R&D activities with other organizations from government, industry, and academia particularly related to intelligent vehicle/highway systems (IVHS).

Transportation Energy and Productivity Office

This office manages the Transportation Energy and Productivity Program (TEPP), which aims to increase the energy and operational efficiency and productivity of Ontario's transportation and to reduce transportation's impacts on the environment. Also TEPP aims to reduce Ontario's dependence on crude oil as an energy source, since oil is a non-renewable resource which comes from outside the province. In promoting energy efficiency and oil substitution, TEPP's main client groups are the industrial, provincial, and municipal fleets.

TEPP's five sub-programs – Trucksave, Drive\$ave, Municipal, Government Fleetsave, and Alternative Fuels Marketing – encourage the most efficient use of oil through proper vehicle maintenance, appropriate specification of vehicles, good driving habits, and improved traffic management. TEPP also provides information on alternative transportation fuels and promotes the use of propane and natural gas for vehicles (NGV) as viable alternatives to gasoline as motor fuel. For these two fuels, TEPP offers information about fuel and dollar savings, safety, regulations, and availability.

Transportation Industry Office

The Transportation Industry Office (TIO) co-operates with Ontario's transportation sector to develop products and capabilities that will make the sector more productive at home and more competitive in the world export market.

Its objectives are to promote business opportunities through the development of new products and processes: to provide a point of contact for industrial co-operation; and to participate with business and other government agencies in addressing the needs of the international transportation market.

Administration and Technical Publications

Financial and personnel administrative services are provided centrally for the branch. A computerized resource management information system is used to facilitate the zero-based budgeting process.

Editing, word processing, typesetting, design, computer graphics, and desktop publishing services are available to assist staff with presentations, research reports and society papers. Reports and promotional material are published and distributed free to libraries, governments, companies, and individuals all over the world.

ALTERNATIVE FUELS

TEMP

A STRATEGY FOR THE UTILIZATION OF ALTERNATIVE FUELS IN HEAVY TRUCKS AND DIESEL BUSES

Authors: A. Mouaket, J. Patriarche

This report addresses the government's interest in helping to make alternative fuels commercially viable to the users of heavy diesel engines. The framework employed to prepare the strategy was comprised of a good understanding of the objectives of government in energy, the advantages and disadvantages of available alternatives, and the capabilities of the various actors. The fundamental principles governing the strategy are to keep options open as far into the future as possible; focus effort on the most promising technologies first; get the private sector involved as much as possible; start small and grow over time; and continually keep the program on the right track.

Published by: TEMP, November 1982, 76 pp.

Participating Agency: Ministry of Energy

TEMP

SWITCHING TO NATURAL GAS – A GUIDE TO SUCCESSFUL CONVERSION

This booklet has been prepared as a guide to those who have decided to convert vehicles from gasoline to natural gas and would like more information on all of the requirements for a good natural gas conversion.

Published by: TEMP, March 1985, revised August 1985, 40 pp.

Participating Agency: Ministry of Energy

TEMP

SWITCHING TO PROPANE – A GUIDE TO SUCCESSFUL CONVERSION

This booklet has been prepared as a guide to those who have decided to convert vehicles from gasoline to propane and would like more information on all of the requirements for a good propane conversion.

Published by: TEMP, March 1985, revised February 1987, 40 pp.

Participating Agency: Ministry of Energy

TEMP

ALTERNATIVE TRANSPORTATION FUELS BOOKLETS

The government of Ontario has launched the Alternative Transportation Fuel (ATF) Program with the objective of reducing the transportation sector's dependence on petroleum fuels from 100% to 90% by 1995. The program involves all aspects of alternative fuels from supply to utilization. This series of booklets is aimed at exploring the technical aspects of using alternative fuels to help meet Ontario's demand for transportation energy. Separate booklets on each of the following are available:

Alcohol Fuels, Electricity, Hydrogen, Natural Gas, and Propane.

Published by: TEMP, September 1985

TEMP

TESTING AND EVALUATION OF AUTOMOTIVE PROPANE CONVERSION EQUIPMENT: 1

Author: L. Segal

This report compiles the data on the comparative tests of eight propane carburetion systems on a GM V6 229 CID code K-1980 engine. The results for power, fuel economy, and emissions are compared with the baseline data obtained on the same engine operating on gasoline. The energy efficiency can be improved by 5-15% depending on load and speed. Because propane is 30% lighter than gasoline, in volume terms the use of propane still results in a 5-25% increase in fuel consumption. However, an appreciable economic advantage can result if propane price is realistically established in comparison with gasoline for an equivalent energy content.

Published by: TEMP, February 1982, 208 pp.

Participating Agencies: Ministry of Energy, Department of Mechanical Engineering, University of Toronto

TEMP

TESTING AND EVALUATION OF AUTOMOTIVE PROPANE CONVERSION EQUIPMENT: 2

Authors: J.F. Keffer, L. Segal

A series of tests has been carried out on a Ford 4.9 L (300 CID) I-6 engine model BF 251 AB, with respect to the optimization of selected principles of propane carburetion systems (IMPCO, Beam, AFS). The criteria were the performance of the engine, fuel economy, and emissions. Results indicate that output power is equal to the power developed using gasoline and the fuel energy efficiency is improved by 3.8-17.8% for the best systems. Through optimization of air/fuel ratio and timing, a further improvement of efficiency was achieved. The exhaust gas temperatures are comparable with those encountered for gasoline, if the timing and air/fuel ratio are correct. Hydrocarbons and carbon monoxide emissions are lower and nitrogen oxide emissions are higher than for gasoline (measured before catalytic converter).

Published by: TEMP, March 1982, revised June 1982, 180 pp.

Participating Agency: Ministry of Energy, Department of Mechanical Engineering, University of Toronto

TEMP

TESTING AND EVALUATION OF AUTOMOTIVE PROPANE CONVERSION EQUIPMENT: 3

Authors: J.F. Keffer, L. Segal

A series of tests has been carried out on a Ford V8 6.1 (370 CID) LIMA engine to evaluate a number of propane carburetion systems (AFS, Beam, IMPCO) embodying various principles of design. Criteria were the performance of the engine, fuel economy and emissions. A new carburetion system design, the OXIN, was included in the evaluation. Results indicate that output power is equal to the power developed using gasoline and the fuel energy efficiency is improved by 10.8-21.0% for the best systems. Through optimization of air/fuel ratio and timing, a further improvement of

energy efficiency between 3.4-18.3% was achieved.

Published by: TEMP, March 1982, revised June 1982, 105 pp.

Participating Agency: Ministry of Energy, Department of Mechanical Engineering,
University of Toronto

AT-82-01

ASSESSMENT OF AUTOMOTIVE TECHNOLOGY FOR ENERGY CONSERVATION AND COMMERCIALIZATION OPPORTUNITIES – A GROUNDWORK STUDY

Author: A. Palm-Leis

This study develops the groundwork for the automotive technology assessment capability: to detail the basic assessment approach and procedure, present a description of the elements, tools and concepts used in the actual assessment, and discuss all significant implications of introducing technological changes into the vehicle as a system. "Assessment" refers to a full evaluation of the viability of a fuel economy measure for Ontario conditions. The study covers all direct and indirect impacts on vehicle fuel economy, impacts on the other design attributes, as well as the life-cycle cost of the measure and the projected fleet-wide fuel-saving potential. The study quantitatively examines where the fuel energy goes, thereby indicating opportunities for achieving fuel economy gains and the magnitude of such gains. This includes establishing the effect of the basic vehicle design variables on fuel economy and on other vehicle performance indicators.

Published by: TEMP, November 1982, 42 pp.

Participating Agency: Ministry of Energy

AF-82-02

CHASSIS DYNAMOMETER TEST RESULTS WITH TWO CNG/GASOLINE DUAL-FUEL VEHICLES

Author: T. Topaloglu

In an effort to assess the effectiveness of the CNG conversion equipment and technique used by Consumers' Gas, two of their dual-fuel utility vans were tested at the MTO chassis dynamometer facility. The fuel consumption, exhaust emissions, and performance of these vehicles were measured with gasoline and natural gas on a set of well-defined driving cycles, under controlled environmental conditions. The test results indicate that vehicles running on natural gas may achieve energy utilization efficiencies comparable to and higher than those achieved while running on gasoline. However, efficiency improvements are not guaranteed with every application. Successful application appears to require optimization of the engine/conversion kit combination. Higher energy efficiencies are accompanied by a significant reduction in carbon monoxide emissions and peak power rating. No major effects were observed on the emission of hydrocarbons and nitrogen oxides.

This testing will be complemented by a systematic engine/conversion kit optimization and by testing on the road, and on the chassis and engine dynamometers.

Published by: Automotive Technology and Systems, TEMP, December 1982, 18 pp.

Participating Agency: Ministry of Energy

FEDERAL/PROVINCIAL METHANOL VEHICLE TEST PROGRAM

Authors: D. Elliott, M. Tsang

Three gasoline vehicles, a Honda Accord, a VW Rabbit, and a Ford Fairmont have completed testing with gasoline, and with 10% and 15% methanol mixtures in gasoline. Testing has comprised chassis dynamometer measurements of fuel consumption, emissions, and driveability. In addition, vehicles have been placed in road service and retested to assess some of the effects of longer term exposure to fuels containing methanol. An experimental, White/Texaco stratified-charge, multifuel engine has also undergone tests. The fuels used were gasoline, ethanol, methanol, and 70% methanol in gasoline.

Published by: TEMP, March 1983, 134 pp.

AF-84-01

EXPERIMENTAL EVALUATION OF SELECTED ADSORPTION MEDIA FOR STORAGE OF COMPRESSED NATURAL GAS

Authors: S. Barton, J. Dacey, M. Evans, D. Quinn

A volumetric adsorption apparatus for the measurement of adsorption isotherms for methane on microporous solid adsorbents at pressures up to 200 atmospheres has been constructed. Measurements on six microporous carbons have been made at -30, 0 and 25°C and on two molecular sieves at 25°C. All the carbons absorbed more methane than the molecular sieves. Lower temperatures increase the amount of methane adsorbed. There is always an advantage, as determined by energy density, in adding adsorbent to the storage system. This advantage is greatest at low pressures (less than 80 atmospheres) and diminishes to a trivial amount at high pressures (200 atmospheres). No relationship was found between the amount of methane adsorbed on these carbons and any parameter used in their characterization. Standard surface area measurements give some indication of how much methane may be adsorbed but some large discrepancies were observed.

Published by: Automotive Technology and Systems, TEMP, April 1984, 28 pp.

Participating Agency: Ministry of Energy

AF-84-02

COLD-STARTING PERFORMANCE OF METHANOL AND GASOLINE/METHANOL BLENDS IN SPARK-IGNITION ENGINES

Authors: M.F. Bardon, V.K. Rao, D.P. Gardiner

This report describes a research program on the cold-starting performance of methanol and several 90% gasoline / 10% methanol blends. Starting trials were conducted using a small spark-ignition engine in a cold test chamber. Test results show the influence of fuel/air ratio on the minimum temperature at which starting could be obtained using the various fuels. A preliminary mathematical model was developed which includes the effects of heat loss to the cold cylinder walls and fuel evaporation. The model assumed continuous shifting vapour/liquid equilibrium throughout the compression process. Predicted results were compared to experimental data. The model proved capable of defining the best cold-starting performance possible for methanol; however, fuel evaporation rate effects change the fuel/air ratio at which this performance actually occurs in the real engine.

Published by: Automotive Technology and Systems, TEMP, November 1984, 50 pp.

Participating Agencies: Ministry of Energy, Royal Military College of Canada

AF-84-03

STRAIGHT METHANOL AND VEHICLE EVALUATION – PHASE 1: THE COLD WEATHER PERFORMANCE OF A VARIETY OF METHANOL FUEL BLENDS
Author: D.K. Mitchell

This report presents the results and evaluations of adding volatile blending agents to methanol. A variety of volatile blending agents were added to methanol and evaluated in two 1983 Ford Escorts which were factory-equipped for operation on near-neat methanol fuel. The addition of these agents helps alleviate the poor cold weather startability and driveability associated with the use of methanol in spark-ignition engines.

Published by: Automotive Technology and Systems, TEMP, April 1984, 50 pp.
Participating Agency: Ministry of Energy

AF-84-04

THE PRODUCTION AND EVALUATION OF COMPOSITE CARBONS FOR THE ADSORPTION OF METHANE

Authors: S. Barton, J. Dacey, M. Evans, J. Holland, D. Quinn

Some novel charcoal adsorbents have been investigated to determine their suitability for storage of compressed natural gas as a vehicular fuel. Carbons have been prepared from the pyrolysis of polyvinylidene chloride and fluoride, alone and mixed with commercial adsorbent charcoals. High pressure adsorption measurements of the materials have shown enhanced storage on a volume basis compared with previously available material. This is due to the higher bulk densities achieved.

Published by: Automotive Technology and Systems, TEMP, June 1984, 21 pp.
Participating Agency: Ministry of Energy

NG-84-01

DEMONSTRATION OF CNG UTILIZATION IN PRIVATE SECTOR FLEETS – FINAL REPORT

This paper reports on the observations and analysis of the two-year program undertaken by Consumers' Gas, i.e., a study of the utilization of CNG in private sector fleets. Problems, advantages, and disadvantages of the conversion were specified.

Published by: Automotive Technology and Systems, TEMP, March 1984, 61 pp.
Participating Agencies: Ministry of Energy, The Consumers' Gas Company Ltd.

NG-84-02

NATURAL GAS AS AN AUTOMOTIVE FUEL: AN ANALYSIS OF THE CONSUMERS' GAS DEMONSTRATION PROGRAM

Author: T. Topaloglu

The technology and economics of natural gas as a vehicle fuel in Ontario were successfully demonstrated by Consumers' Gas in a program funded by industry and government. A slow/fast-fill compressed natural gas (CNG) fuelling station with a nominal capacity was built and 22 service vans were converted to operate on a CNG/gasoline dual-fuel mode. The station and fleet operations were carefully assessed and reported on over a one-year period by Consumers' Gas. The monitoring and support functions were carried out by MTO. This report was prepared by MTO to summarize and interpret the technical and economic information.

Published by: Automotive Technology and Systems, TEMP, April 1984, 47 pp.
Participating Agency: Ministry of Energy

NG-84-03

TESTING AND EVALUATION OF AUTOMOTIVE NATURAL GAS CONVERSION EQUIPMENT – PHASE 1

Authors: L. Segal, J.F. Keffer

A test program has been carried out on a Ford 4.9 L (300 CID) to evaluate the results of conversion to natural gas (NG) fuel and to compare four available NG carburetion systems – AFS, IMPCO, Beam, and CNG. During the program, the power at WOT, specific fuel consumption, and emissions at different speeds and loads were monitored and compared with the baseline test on gasoline. The power developed using NG was lower than for gasoline and the energy efficiency was reduced for all systems tested. Hydrocarbons emission was increased. Through timing and air/fuel ratio optimization, an improvement of economy at partial loads was achieved. More basic research is required to increase the efficiency of natural gas use.

Published by: Automotive Technology and Systems, TEMP, June 1984, 110 pp.

Participating Agencies: Ministry of Energy, Department of Mechanical Engineering, University of Waterloo

AF-85-01

THE DEVELOPMENT OF ADSORBENT CARBON FOR THE STORAGE OF COMPRESSED NATURAL GAS

Authors: S. Barton, J. Holland, D. Quinn

This report is the third in a series dealing with the development of adsorbents for the storage of compressed natural gas on board vehicles. A previously identified carbon product, based on Saran polymer, has been prepared in kilogram quantities. To minimize void space, monolithic pieces have been made in the form of discs to fill a container. The material has been repeatedly filled with methane under pressure and then emptied to test thermal effects, durability under cycling, etc. Additional work has also been done to improve the basic properties of the material by steam activation.

Published by: Automotive Technology and Systems Office, TEMP, May 1985, 63 pp.

Participating Agencies: Ministry of Energy, Royal Military College of Canada

AF-85-03

STRAIGHT METHANOL AND VEHICLE EVALUATION – PHASE 2: DURABILITY OF A FLEET OF METHANOL-FUELLED VEHICLES

Author: D.K. Mitchell

A fleet of Ford Escort vehicles designed to run on methanol has been evaluated under a program of short- and long-distance accumulation, using appropriately designed fuel and oil formulations. Durability was checked by detailed measurements of the stripped down engine components at the beginning and end of the test period. This was supplemented by regular sampling and analysis of the engine oils used by the vehicles. On-the-road fuel consumption of the fleet was monitored, and operational problems, including those of the fuel dispensing system, were recorded and remedied where possible. Cold weather driveability was examined on selected vehicles, and some were tested on the chassis dynamometer for fuel consumption and exhaust emissions.

Published by: Automotive Technology and Systems, TEMP, August 1985, 92 pp.

Participating Agencies: Shell Canada Limited, Ford of Canada Limited, Ministry of Energy, Energy, Mines and Resources Canada

AF-86-01

MTC/CELANESE METHANOL VEHICLE TEST PROJECT

Authors: D. Elliott, M. Tsang, R. Chisholm

Methanol fuel formulations have been devised containing oxygenated, methanol-derived volatility primers instead of the customary hydrocarbon components. These were tested on two available methanol vehicles, a Ford Escort and a VW Golf, to determine if adequate low temperature startability could be obtained. Another Ford Escort was operated in a long-distance accumulation mode to examine engine durability on M90. The engine was pre-measured after being run in and then stripped for measurement after 30 000 km. Regular oil sampling and analysis was maintained during this period to supplement wear appraisal. The results showed that, with a few exceptions, component dimensions were within the manufacturers' acceptable tolerances after the distance accumulation.

Published by: Automotive Technology and Systems, TEMP, February 1986, 68 pp.

Participating Agencies: Ministry of Energy, Celanese Canada Inc.

AF-86-02

DFA PROPANE MIXER EVALUATION

Author: D. Petherick

A detailed test of the Dual Fuels Associates (Orem, Utah, USA) propane mixer was conducted at the MTO Downsview chassis dynamometer facility. The unique-design propane mixer was evaluated for air/fuel ratio control, exhaust emissions, and fuel consumption and was compared to a previous propane conversion on the same test vehicle. The results indicate that the mixer is capable of metering propane with reasonable precision without offering a significant restriction to engine intake airflow.

Published by: Automotive Technology and Systems, TEMP, March 1986, 62 pp.

Participating Agency: Ministry of Energy

AF-86-03

METHANOL VEHICLE ENGINE INSTALLATION AND INITIAL COLD-START TESTING

Authors: M.F. Bardon, D.P. Gardiner, N.T. O'Brien, V.K. Rao, O.P. Nijhawan

A new cold chamber has been constructed to be used for cold-starting performance testing of full-size automobile engines. A 1.6 L Ford Escort engine designed for methanol fuel operation has been installed. Shakedown testing has been conducted in which the engine was successfully started on pure methanol at temperatures as low as -6°C.

Published by: Automotive Technology and Systems, TEMP, March 1986, 38 pp.

Participating Agency: Ministry of Energy

AF-86-04

CNG REFUELLING WITH SMALL COMPRESSORS

Authors: M. Tsang, T. Topaloglu

This paper reviews current small compressors designed for refuelling of CNG-powered vehicles. The compressors are intended for use by consumers or small fleet operators. The report examines design criteria, operating principles, performance, durability, and economic feasibility for application in home refuelling.

Published by: Automotive Technology and Systems, TEMP, March 1986, 77 pp.

Participating Agency: Ministry of Energy

AF-86-05

METHANOL/HYDROCARBON FUEL BLEND FLEET DEMONSTRATION PROJECT

Authors: D. Elliott, D. Petherick, M. Tsang, K. Taylor

This project began in 1982, consisting of a fleet test of a low-level blend of methanol/co-solvent/hydrocarbon vehicle fuel. The test involved a fleet of 39 MTO vehicles, closely monitored as to driveability, exhaust emissions, fuel consumption, air/fuel equivalence ratios, engine oil analysis, and driver comments. It was successfully demonstrated that an oxygenated specification gasoline can be produced and maintained in fleet usage, replacing regular unleaded gasoline.

Published by: Automotive Technology and Systems, TEMP, June 1986, 91 pp.

Participating Agencies: Ministry of Energy, Suncor, Alberta Gas Chemicals Ltd.

AF-86-06

NATURAL GAS VEHICLE DEMONSTRATION BY UNION GAS

Authors: NGV and Transportation Engineering Department, Union Gas Limited

During a two-year study period, a 25-vehicle fleet operated on natural gas to assess the potential cost savings. A 35% fuel cost saving was realized with a two-year average CNG usage of 77% for the dual-fuel (gasoline/natural gas) fleet.

Published by: TEMP, June 1986, 77 pp.

Participating Agencies: Ministry of Energy, Union Gas Ltd.

TEMP-86-03

ALTERNATIVE TRANSPORTATION OPERATIONAL PLAN 1986/87

Author: T. Topoglu

The Automotive Energy Section serves TEMP to provide technical and scientific support for the Ontario government goals of reduced dependence on conventional petroleum resources, efficient transportation, and industrial expansion. It consists of highly qualified engineers and scientists who are supported by ready access to MTO vehicle fleets and by MTO facilities including an EPA-type chassis dynamometer laboratory, a cold-soak chamber, a vehicle maintenance garage, fuel storage and handling facilities, and analytical/electronic laboratories. These capabilities qualify the section to conduct and oversee external research, development, and demonstration projects for the ATF Program in co-operation and consultation with private sector companies, research institutions, and MENY. This report discusses projects dealing with technology development, applied research, and fleet testing.

Published by: TEMP, September 1986

AF-86-07

STRAIGHT METHANOL AND VEHICLE EVALUATION – PHASE 3: FURTHER DURABILITY TESTING OF A FLEET OF METHANOL-FUELLED VEHICLES

Author: D.K. Mitchell

Six methanol-fuelled vehicles have been operated over a severe multiple short-trip mode of distance accumulation. Pairs of vehicles were run for the duration of the test, with three different engine oil formulations designed to control engine wear. The vehicle engines were stripped and measured at the beginning and end of the period so that direct assessment of wear could be made. This was supplemented with

regular sampling and analysis of the oil to check for trace wear metals and deterioration of lubricant quality. A range of methanol fuel compositions containing from 78 to 90% methanol was used over the period, and the volatility was seasonally adjusted with the addition of gasoline as well as, in some cases, dimethyl ether.

Published by: TEMP, November 1986

Participating Agencies: Ministry of Energy, Shell Canada Ltd., Ford of Canada Ltd., Energy, Mines and Resources Canada

AF-86-08

PERFORMANCE OF FIRST GENERATION NGV KITS – ENGINE AND CHASSIS DYNAMOMETER TEST RESULTS

Authors: T. Topaloglu, D. Elliott

The performance of commercial automotive CNG conversion equipment was evaluated by means of engine and chassis dynamometer tests. In the engine dynamometer tests, four typical conversion systems were assessed on 4.9 L I-6 and 6.1L V-8 spark-ignition engines. In the chassis dynamometer tests, two of the conversion systems were assessed on a pickup truck equipped with the 4.9 L engine. In this paper, related results are discussed to explore the potential of improving upon the present CNG conversion technology.

Published by: Automotive Technology and Systems, TEMP, November 1986

Participating Agency: Ministry of Energy

AF-86-09

PROPANE AND NATURAL GAS IN THE ONTARIO TRANSIT INDUSTRY

Author: T. Topaloglu

In two independent and unique demonstrations, Ottawa-Carleton Transpo and Hamilton Street Railway, are assessing the viability of propane and natural gas as alternatives to diesel fuel in transit bus fleets. In this paper, the experience gained in the engine and bus conversions, the performance and reliability of the buses and fuelling facilities, the preliminary economics of the alternative fuels, and the results of the test phase are presented.

Published by: TEMP, November 1986

Participating Agencies: Ministry of Energy

AF-87-01

STRAIGHT METHANOL AND VEHICLE EVALUATION – PHASE 4: DURABILITY OF A FLEET OF METHANOL-FUELLED VEHICLES IN NORMAL SERVICE

Author: D.K. Mitchell

A group of six Ford Escorts has been operated for a year in a mainly highway mode, using specifically formulated oils. The oils had been designed from earlier results in previous phases of the program to resist the more aggressive effects of methanol fuel on engine components. Wear effects have been monitored by regular checks on used oil quality and by comparison of the stripped down engine at the beginning and end of the test period.

Published by: Automotive Technology and Systems, TEMP, February 1987

Participating Agency: Ministry of Energy

AF-87-02

THE DEVELOPMENT AND PERFORMANCE TESTING OF ADSORBENT CARBON FOR THE STORAGE OF COMPRESSED NATURAL GAS

Authors: S. Barton, J. Dacey, M. Evans, J. Holland, D. Quinn

Some promising composite carbons made of mixtures of polyvinylidene chloride (Saran) and commercial charcoals have been prepared in monolithic form in litre quantities. These have been subjected to repeated fill/empty cycling with a commercial-grade gas to measure the effect of impurities on the amount of gas delivered. Work has also proceeded to improve the formulation by preparing gram samples of various proportions of Saran and charcoals. These have been tested for basic adsorption properties, and promising compositions have been selected for scaled-up fill/empty cycling. Finally, attempts were made to improve the basic adsorption properties of Saran-derived carbons by incorporating fluorine atoms into the material. No positive benefits were found in this case.

Published by: TEMP, March 1987, 57 pp.

Participating Agency: Royal Military College of Canada

AF-87-04

ASSESSMENT OF PROPANE/BUTANE MIXTURES AS MOTOR FUEL IN AUTOMOTIVE VEHICLES

Author: R.F. Webb Corporation Ltd.

This study has been made because of the need for and feasibility of augmenting the supply of automotive propane by the production of a mixed butane-propane automotive fuel, also called liquefied petroleum gas (LPG). This study also addressed the potential performance of vehicles using the new fuel, safety, and other key issues, including research, development, and engineering, which might be conducted to resolve the performance issue.

Published by: TEMP, April 1987, 82 pp.

Participating Agencies: R.F. Webb Corporation Ltd., Ministry of Energy

AT-87-00

THE IMPACT OF BRAKE RETARDERS ON BUS LIFE-CYCLE COST

Author: J.E. Turner

Brake retarders are not new to the trucking industry. For many years, they have supplemented air brake systems, providing greater fade resistance and improved brake performance on hilly terrain. Retarders have been purchased by truck owners primarily to improve the level of safety in truck operations. The purpose of this paper is to detail the study that determined the impact of a retarder on the life-cycle operating cost of a typical transit bus in Ontario.

Published by: Automotive Technology and Systems, November 1987, 79 pp.

AF-88-00

PROPANE BUS DEMONSTRATION – OTTAWA-CARLETON REGIONAL TRANSIT COMMISSION

AND

**EXECUTIVE AND TECHNICAL SUMMARY REPORT ON
PROPANE BUS DEMONSTRATION – OTTAWA-CARLETON REGIONAL TRANSIT COMMISSION**

R.F. Webb Corporation Ltd.

The Ottawa-Carleton Regional Transit Commission (OC Transpo) conducted a 37-month demonstration of the use of propane-fuelled buses in revenue service. Data on the safety, operation, maintenance, and economics of the 10 buses in the propane fleet are assembled and compared with those from a 12-month monitoring of a fleet of 10 diesel-engine buses of the same age and type.

The overall assessment is that propane buses provided a satisfactory level of performance compared to the diesel buses under the conditions of the demonstration.
Published by: Vehicle Technology Office, March 1988.

AT-88-00

DYNAMOMETER EVALUATION OF THE FORD FLEXIBLE FUELLED VEHICLE

Authors: D. Elliott, T. Topaloglu

A jointly funded government/industry program has been in operation since 1986 to manufacture and evaluate a small fleet of prototype flexible fuelled vehicles (FFV). These are designed to operate with automatic engine adjustment either on gasoline or on a methanol-rich fuel. One of these vehicles has been tested at the MTO chassis dynamometer facility on five different fuels varying in composition between gasoline and M85 (85% methanol, 15% gasoline). Fuel consumption and the regulated emissions of formaldehyde and other carbonyl compounds, which are not yet regulated, were also measured.
Published by: Automotive Technology and Systems, TEMP, May 1988, 23 pp.
Participating Agency: Ministry of Energy

AF-88-02

GUIDELINES TO IMPROVED PERFORMANCE AND FUEL CONSUMPTION OF PROPANE CONVERSIONS

Authors: J.S. Wallace and L. Segal

Aimed at technicians converting gasoline-fuelled vehicles to operate on propane, this report includes: a brief overview of propane characteristics; requirements for satisfactory engine operation on propane, including factors that affect maximum power output, fuel consumption, and emissions; as well as recommended tuning procedures.
Published by: Vehicle Technology Office, August 1988, 26 pp.

AF-88-03

EVALUATION OF COMPRESSED NATURAL GAS CONVERSION SYSTEMS

Author: T. Topaloglu

The performance of commercial compressed natural gas automotive conversion equipment is evaluated on the bases of fuel consumption, exhaust emission, and acceleration performance results obtained in the MTO chassis dynamometer laboratory. The conver-

sion equipment was supplied by the Diversified Fuel Components and CNG Fuel Systems companies of Ontario and was installed on a 5-L spark-ignition engine in a Ford F-150 pickup truck, which was operated as a CNG/gasoline dual-fuel vehicle.
Published by: Vehicle Technology Office, August 1988, 54 pp.

AF-88-00

**HAMILTON STREET RAILWAY COMPRESSED NATURAL GAS BUS
DEMONSTRATION PROJECT – FINAL REPORT ON PHASES 1-3**

Authors: R.F. Webb Corporation Ltd.

This report details the findings and conclusions of a demonstration at Hamilton Street Railway of the feasibility of operating compressed natural gas (CNG) buses in transit service. Six buses were converted to operate on CNG; data on costs, performance, and reliability were gathered. The demonstration defined the needed changes in the engine, bus, and refuelling system.

Published by: Vehicle Technology Office, Sept. 1988.

AF-88-05

**A COMPARISON OF THE DURABILITY OF METHANOL- AND GASOLINE-
FUELLED VEHICLES**

Author: D.K. Mitchell

A fleet of Ford Escorts was evaluated for engine durability. Five of the vehicles operated on near-neat methanol fuel (fuel-methanol) while two operated on gasoline. Durability was determined by both pre- and post-measurement of engine components and analyses of the vehicles' used engine oil at regular intervals. Fuel consumption and maintenance problems were also monitored. Results indicate that engine wear was not significantly worse with the fuel-methanol cars. Deposits were lower with the fuel-methanol cars. However, the three high mileage fuel-methanol cars suffered premature engine failures due to pre-ignition initiated damage.

Published by: Vehicle Technology Office, November 1988, 62 pp.

AF-89-01

NATURAL GAS BUS IMPLEMENTATION AT TTC'S LANSDOWNE GARAGE

Authors: J. Turner, T. Topaloglu, R. Monster

The Vehicle Technology Office conducted a detailed investigation into the facilities and operations at the TTC's Lansdowne garage, with respect to the TTC's recent decision to implement natural gas powered buses at this location.

This report details the findings of the investigation, which are required to define the NG refuelling equipment and to forecast the impact on current operations.

Published by: Vehicle Technology Office, May 1989, 45 pp.

AF-89-02

FUNDAMENTAL FLAMMABILITY DATA FOR METHANOL-BASED SPARK-IGNITION ENGINE FUELS

Authors: M.F. Bardon, G.W. Nicks, D. Gauthier, V.K. Rao, O.P. Nijhawan, R. Valvads, J. Holland

The purpose of this program was to develop fundamental data related to the combustion behaviour of methanol fuel blends in spark-ignited engines. The following are the principal results: The distribution of methanol and hydrocarbon components in the vapour phase was determined experimentally for states consisting of different proportions of liquid and vapour; a mathematical model was developed that predicts the vapour pressure and phase composition of methanol blends; the model was validated by direct comparison with experimental data; the model was used to show that decreased temperature affects M85 more than gasoline in reducing vapour pressure; and the lean flammability limits have been predicted for M85 blends at the various stages of evaporation, and verified experimentally.

Published by: Vehicle Technology Office, Sept. 1989, 125 pp.

AF-90-01

THE DEVELOPMENT OF NATURAL GAS BUSES IN ONTARIO

Authors: M.D. Harmelink, O.M.S. Colavincenzo

This paper focusses on the natural gas vehicle portion of a joint federal, provincial, and private sector technology development program to reduce the consumption of oil. The program resulted in a series of developments and demonstrations in light- and heavy-duty vehicles and showed the technical feasibility of using alternative fuels, such as propane and natural gas, in the transportation sector. One of the outcomes of this program was the development and demonstration of natural gas powered buses. These buses were developed for environmental, health, energy security, and economic reasons. The development program was initiated in 1988 to develop and demonstrate 50 natural gas powered buses. The buses will be demonstrated in Toronto, Hamilton, and Mississauga and are expected to go into service in the latter half of 1990.

Published by: Vehicle Technology Office, May 1990, 15 pp.

AF-90-02

DEVELOPMENT AND DEMONSTRATION OF A CLASS 8 PROPANE-POWERED TRUCK

Authors: G. Hrynyk, J. Turner, T. Topaloglu

A 261 kW (350 hp) spark-ignited, turbocharged, and aftercooled Cummins "Big Cam" propane engine was developed and tested for class 8 truck application. Two propane engines were operated in line-haul service for a total of 33 months and almost 350 000 km. A diesel-powered tractor, in similar service, was monitored for comparison.

Fuel economy, oil consumption, maintenance, drivers' comments, and engine refinements were fully documented. Propane fuel economy averaged 94 L/100 km, relative to 45 L/100 km with the diesel. Overall reliability was good and driver acceptance excellent; however, further refinements, especially in the turbocharger, ignition, and cooling system, are required to compete with the modern diesel.

Published by: Vehicle Technology Office, July 1990, 14 pp.

TTE-91-01

**A REVIEW OF THE PROVINCIAL TRANSPORTATION IMPACTS OF THE
CANADIAN MANAGEMENT PLAN FOR NO_x/VOCs: ONTARIO PERSPECTIVE**

Authors: M.D. Harmelink, O.M.S. Colavincenzo

This paper discusses the impacts of recommendations contained in a management plan for the control of nitrogen oxides (NO_x) and volatile organic compounds (VOCs), delivered to the Canadian Council of Ministers of the Environment in 1990. In the paper, the benefits and costs of implementing structural changes such as new emission standards for both light and heavy-duty vehicles are reviewed. Also, means for controlling the emissions of in-service vehicles are explored. Finally, the effectiveness of implementing urban transportation management plans, and the impact of altering our lifestyle by introducing restricted days and stricter enforcement of speed limits are discussed.

Published by: Transportation Technology and Energy Branch, January 1991, 18 pp.

AT-91-01

ASSESSMENT OF TRANSIT BUS PROPULSION OPTIONS IN ONTARIO

Authors: T. Topaloglu, J. Turner, D. Elliott, D. Petherick

This report discusses the 1990-91 status of the technology, economics, and environmental aspects of diesel, propane, natural gas, methanol, and electricity powered transit buses. The relative economics of each of these alternatives is assessed by means of a comprehensive life-cycle cost analysis.

Most of the information used in this analysis and elsewhere in the report is based on the experience generated in research, development, and demonstration projects undertaken by the Ontario Ministry of Transportation.

Published by: Vehicle Technology Office, March 1991, 101 pp.

COMMERCIAL VEHICLES

CVOS-TR-78-04 SIMULATION OF SEVERAL JACKKNIFE CONTROL DEVICES

Author: A.M. Billing

A jackknife control device is any device that aids in reducing the probability of an articulated road vehicle jackknifing. An existing computer-based model of the tractor-semitrailer response to braking and steering has been modified to include five such devices. These five devices are those manufactured by Safe-T-King (Canada), Hope (U.K.), and Breeze and Mather (U.S.), in addition to those products generically known as antilock braking systems. This report describes the characteristics of the vehicle model, in addition to the models of the jackknife control devices. These models are based on measured device properties. Instructions and examples are included to enable users to run the program.

Published by: Commercial Vehicle Operations and Safety, May 1978, 105 pp.

Participating Agencies: Transport Canada, Highway Safety Research Institute of Michigan.

CVOS-TR-79-03 TRUCK AND TRACTOR SEMITRAILER TRANSIENT OFFTRACKING METHODS

Authors: C. Choi, F.B. Snelgrove

The manoeuvrability of an articulated vehicle is usually defined by its maximum offtracking characteristics. This limit is rarely reached, even in tight manoeuvring where it is the most important. The transient offtracking characteristics that occur during a change in road curvature can be derived in several ways, ranging from full-size vehicle tests to mathematical analysis. In this note, a computer program that derives the turning path and the envelope swept out by a tractor semitrailer in a circular turn is derived. The program is based on a graphical process using a pure pursuit principle and gives the paths of various points of interest on the vehicle related to its manoeuvrability. The advantages and disadvantages of the computer method are discussed and the results compared with those trained by other methods.

Published by: Commercial Vehicles Operations & Safety, Systems Research & Development Branch, April 1979, 43 pp.

CVOS-TR-79-06 AIR LIFT AXLE STUDY

Authors: C. Choi, F.B. Snelgrove

Preliminary tests were carried out on a single tri-axle configuration with the forward axle air-liftable, self-steering or equipped with slicks (treadless tires), to determine whether there was any basis for a full-scale study of the effects of the forward axle on stability and manoeuvrability. Tests were carried out on dry pavement, looking primarily at roll stability during a lane change and manoeuvrability of the vehicle in 90° and 270° turns with and without the forward axle in operation. The test vehicle was not equipped with a call preventative mechanism, so tests were conducted well below the rollover threshold and can only be considered indicative, although the results are generally substantiated by separate analysis. Two alternatives, the self-steering axle and slicks on the forward axle, were also examined and showed excellent potential to reduce the main problem of tire scrub and wear associated with the tri-axle configuration.

Published by: Commercial Vehicles Operations and Safety, September 1979, 36 pp.

CVOS-TR-80-01 THE FUEL ECONOMY, STABILITY AND PAVEMENT EFFECTS OF THE WIDE BASE RADIAL TIRE

Author: F.B. Snelgrove

The trucking industry, faced with ever increasing fuel and operational costs, has been taking a close look at the wide base radial tire as a replacement for conventional dual tires. With the potentially large fuel savings available and the better operational economics, MTO undertook to determine the possible fuel savings and to re-evaluate its regulatory position on the axle loads for the wide base singles. Also, to take into consideration the safety aspects of changing over to the wide base radial, their effect on vehicle stability was included in this research. The research was carried out under three separate projects covering the areas of fuel economy, vehicle stability and safety, and pavement deflection and damage.

Published by: Vehicle Systems, May 1980, 71 pp.

Participating Agency: Alberta Research Council

CVOS-TR-80-03 PERFORMANCE EVALUATION OF SEVERAL JACKKNIFE CONTROL DEVICES

Authors: F.B. Snelgrove, A.M. Billing, C. Choi

A comprehensive evaluation of the performance of four jackknife control systems is presented. Each device is described in detail and was tested in lane change and circular turn manoeuvres with braking conditions designed to cause a tractor jackknife or trailer swing. The devices tested were the Hope Anti-Jackknife Device, the Breeze Control System, and the Mather Anti-Jackknife Device. The Mather Anti-Jackknife Device was not available and was evaluated based on simulation analysis. Methods of evaluation include distance and time out of lane, a speed safety margin, yaw rates, and an evaluation based on changes in dynamic characteristics caused by the devices. Results indicate that all of the devices offered some improvement in a jackknife.

Published by: Vehicle Systems, October 1980, 144 pp.

Participating Agencies: Transport Canada, Safe-T-King, Hope Manufacturing, Kelsey-Hayes, Breeze Manufacturing.

CVOS-TR-80-04 COMMERCIAL VEHICLE AIR BRAKE TIMING: A SPECIFICATION EVALUATION

Authors: M. Wolkowicz, W. Stephenson

Commercial vehicle air brake system timing is a vital factor in the safe operation of commercial vehicles on public highways. This report evaluates the measured application and release times of an air brake system on an MTO combination vehicle using the Federal Motor Vehicle Safety Standard - 121 (1976) as a reference. Several factors have been identified that affect air brake timing. It has also been noted that the specifications as stated in FMVSS -121, and the method used to measure the application of this standard, do not represent the "real world" of commercial vehicle operations. The development of a combined vehicle air brake timing specification rather than the individual vehicle specification as defined by FMVSS -121 is required to bring commercial vehicle air brake timing into proper perspective.

Published by: Vehicle Systems, December 1980, 45 pp.

Participating Agencies: Kelsey-Hayes Company, Raybestos-Manhattan Inc.

CVOS-TR-80-07 A PRELIMINARY SIMULATOR STUDY OF THE OBSTACLE AVOIDANCE MANOEUVRE

Authors: L.D. Reid, W.O. Graf, A.M. Billing

This report describes the validation of a mathematical driver model for an obstacle-avoidance manoeuvre. The major portion of the investigation was devoted to the gathering of data on driver behaviour while controlling a car and a truck under these conditions. This was carried out in a fixed-base driving simulator employing a computer-generated display of the driver's forward view. The obstacle-avoidance manoeuvre was triggered by the fall of one pole of many lining the road in front of the driver. This task was selected because it was felt to be representative of a driving scenario that can lead to road accidents. The data were analyzed and compared with those generated by the driver model. Model parameters were chosen so that reasonable agreement with subject driver response was achieved. The model fit was better in some cases than in others, and improvements to the model are discussed. Published by: Research & Development Branch, May 1980, 126 pp.

TVS-CV-81-112 SURVEYS OF THE COMMERCIAL VEHICLES AND TRUCK TIRES USED IN THE TORONTO AREA

Authors: T. Wilhelm, A.M. Billing

On-site investigations of commercial vehicle accidents were conducted in the Toronto area over two winters. These surveys were intended to assure the relevance of research projects concerned with commercial vehicle safety. Further data were required to put the accident data in context, leading to the two surveys described in this report. The first survey determines the make-up of the commercial vehicle population based on axle configuration, body style, and weight class. The second survey samples tire tread design used on the traction or drive axles of trucks for comparison with those tread types most often involved in jackknife or other skidding accidents. The surveys describe the present commercial vehicle and traction tire type populations and they demonstrate significant differences between weight classes as well as between straight trucks, tractor/semitrailers, truck trailers, and A- and B-trains.

Published by: Vehicle Systems, December 1981, 36 pp.

RR-235 COMMERCIAL VEHICLE ACCIDENT SURVEY: AN ON-THE-SCENE STUDY

Authors: M. Wolkowicz, A.M. Billing

On-the-scene investigations of 140 commercial vehicle accidents occurring on the highways in the Metropolitan Toronto area were undertaken during the winters of 1979/80 and 1980/81 – a time frame encompassing 249 calendar days. Of these accidents, 108 involved commercial articulated vehicles (CAVs). Although the majority of accident causes were driver-related, other factors such as tire wear, tread design, and inadequate maintenance contributed significantly to accident causation. Summaries of all CAV accidents occurring within the study area/time period were obtained from police traffic reports and analyzed.

Published by: Vehicle Systems, January 1982, 81 pp.

Participating Agency: Ontario Provincial Police (Downsview and Burlington)

TVS-CV-82-108 **THE OBSTACLE AVOIDANCE MANOEUVRE AS PERFORMED IN A TRACTOR/SEMITRAILER TRUCK**

Authors: L.D. Reid, W.O. Graf, A.M. Billing

A series of field trials was carried out employing an instrumented tractor/semitrailer truck and an obstacle-avoidance manoeuvre. Driver/vehicle response records were taken and used as input to a driver model fitting computer algorithm. Linear driver models were successfully fitted to the experimental data and the resulting model parameters are presented. These results span a number of task conditions ranging from very easy to quite demanding.

Published by: Vehicle Systems, June 1982, 76 pp.

Participating Agencies: University of Toronto Institute for Aerospace Studies, General Motors

TVS-CV-82-109 **TEST AND DEMONSTRATION OF DOUBLE AND TRIPLE TRAILER COMBINATIONS**

Authors: W. Mercer, J.R. Billing, M. Wolkowicz

Industry is currently proposing that longer trucks be permitted on Ontario's highways to increase productivity. In support of this, three overlength trucks, a Triple, a Twin 45, and a Double Car Carrier, all 30 to 35 m were made available for testing by the ministry, and for demonstration to the Ontario Commission on Truck Safety. The objectives of the testing were to validate findings of others regarding the characteristics of such vehicles, and to become as familiar as possible with them. Low speed off-tracking, brake system operation, response to an emergency evasive manoeuvre, and splash and spray generation characteristics of all vehicles were evaluated. The report evaluates overlength vehicles in terms of amount of manoeuvring space needed, and the brake system performance of longer trucks made up of standard trailers.

Published by: Vehicle Systems, August 1982, 79 pp.

Participating Agencies: Motor Carriers Ltd, International Carriers Ltd., Inter-City Truck Lines (Canada) Ltd.

TVS-CV-82-111 **TESTS OF A B-TRAIN CONVERTER DOLLY**

Authors: J.R. Billing, W. Mercer, C. Lam, M. Wolkowicz, W. Stephenson

The B-train converter dolly is an alternative to the standard converter dolly used for double trailer truck combinations. The dolly tested had dual drawbars attaching to twin pintle hooks on the lead trailer, preventing articulation at the point of attachment, and a self-steering axle to reduce tire scrub on sharp turns. A series of tests were conducted to determine loads on the dolly through the hitch system. A limited number of similar tests were also performed with an A-train for comparison of the stability and handling characteristics of trains with A- and B-dollies. The offtracking of both was also investigated.

Published by: Vehicle Systems, May 1982, 137 pp.

Participating Agencies: Roads & Transportation Association of Canada, Transport Canada

TVS-CV-82-114 ROLLOVER TESTS OF DOUBLE TRAILER COMBINATIONS

Author: A.M. Billing

Full-scale tests were conducted of the rollover stability of several double-trailer truck combinations in cornering and single and double lane-change manoeuvres. An instrumented vehicle was used to compare A-train and B-train configurations (having three and two points of articulation, respectively) and to investigate the effects of reducing the free play of trailer suspension springs in their frame mounts, and the effects of changing converter dolly hitch length.

Published by: Vehicle Systems, December 1982, 72 pp.

TVS-CV-83-101 AIR BRAKE SYSTEM EVALUATION OF AN OVERLENGTH DOUBLE COMBINATION VEHICLE

Author: M. Wolkowicz

The testing and demonstration of three overlength combination vehicles to the Ontario Commission on Truck Safety by MTO and the trucking industry indicated in part that the service air brake system performance of these vehicles is less than ideal. At present there is no combined vehicle air brake timing standard, federal or provincial, for articulated commercial vehicles. Air brake timing system evaluation on a combination vehicle by MTO in co-operation with the trucking industry, a pilot test on which this report is based, indicates that much can be done by a combination vehicle operator to improve service air brake system response times. The addition of supplemental air valves, such as fast-acting relay and quick release valves, can do much to achieve a more desirable air brake system operation. Similarly, the removal of self-storing service air lines can improve system response.

Published by: Vehicle Systems, January 1983, 21 pp.

Participating Agency: International Carriers Ltd.

TT-CV-84-101 COMPARATIVE STABILITY AND HANDLING CHARACTERISTICS OF AN 8-AXLE LOG-HAUL TRUCK

Authors: J.R. Billing, W. Mercer, C. Lam

The stability and handling characteristics of an 8-axle, log-haul truck of innovative design, developed by Boise Cascade Ltd., have been evaluated by computer simulation in comparison with others in use in the pulpwood haul industry. The Boise Cascade truck was similar to the other typical log-haul vehicles in turning and jackknife susceptibility. However, the Boise Cascade vehicle showed a tendency to rollover at lower speeds than the other three vehicles in entry to a steady turn at maximum legal load. The rollover tendency occurred at progressively lower speeds as the vehicle took on increased payloads. The results of the computer simulation are valid for the vehicle configurations under investigation, and should not necessarily be construed as characteristic of all such vehicles.

Published by: Automotive Technology and Systems, April 1984, 32 pp.

TT-CV-84-104

AIR BRAKE SYSTEM COMPATIBILITY AND TIMING FOR COMMERCIAL VEHICLE COMBINATIONS

Authors: J.R. Billing, M. Wolkowicz, W.R. Stephenson

This report discusses torque balance, pneumatic balance, and pneumatic timing – the three major aspects of air brake system compatibility between the units of a combination vehicle. Their relationships are discussed in the context of the braking demands for normal stopping, braking in a long descent, and severe braking in an emergency situation. The report presents findings and conclusions from a series of static air brake timing measurements made on various vehicles during 1983. The tests showed that the timing and pneumatic balance of multi-unit truck combinations is often less than ideal. Nevertheless, these aspects of air brake system compatibility may readily be improved by the sensible use of existing components, at negligible difference in cost to standard installations. The other related aspect of compatibility, torque balance, is not addressed by the tests reported here, as this issue is much more complicated.

Published by: Automotive Technology and Systems, December 1984, 48 pp.

Participating Agencies: International Carriers Ltd., Inter-City Truck Lines (Canada) Inc., C.P. Express Ltd., Bendix Heavy Vehicle Systems Inc.

TT-CV-84-105

DIRECTIONAL STABILITY AND TIME HISTORY RESPONSE ANALYSIS OF A GENERAL TRUCK COMBINATION

Authors: C.P. Lam, J.R. Billing

A linearized digital computer model has been developed for a general truck combination of arbitrary length which interfaces with the MTO in-house general purpose dynamic analysis package, DYN SYS. The model can be used to study the directional response and stability of heavy commercial vehicles in a horizontal plane. In a preliminary study, the simplicity of the model allows it to be used effectively to identify vehicle combinations for further detailed analysis or field test. The solution capabilities of DYN SYS permit either a stability analysis, a frequency response analysis, or a time history response analysis of the linear equations representing the vehicle.

Published by: Automotive Technology and Systems, July 1984, 59 pp.

TT-CV-84-106

STABILITY OF TRUCK COMBINATIONS

Authors: M. Wolkowicz, J.R. Billing

This is a video script. It summarizes several years of testing by MTO of the stability characteristics of vehicle combinations of the type used (or proposed for use) in commercial trucking in Ontario. The reasons for loss of control are examined together with the factors which contribute to rollover, trailer swing, and jackknife. Comparisons are made between A-train and B-train configurations and their performance under different conditions.

Published by: Automotive Technology and Systems, September 1984, 13 pp.

CV-85-01

**AXLE LOAD DISTRIBUTION CHARACTERISTICS OF A TRIPLE-AXLE TRUCK
SUSPENSION SYSTEM**

Authors: W. Mercer, R. MacDonald

A test of a semitrailer triple-axle suspension, known as the "six-spring" design, revealed that the suspension behaved more like three individual suspended axles rather than a load-equalizing/sharing system. The axle loads were found to vary with axle displacement and chassis attitude, and were often not repeatable. This suspension should, therefore, more appropriately be considered a three-axle group rather than a triple axle.

Published by: Automotive Technology and Systems, October 1985, 42 pp.

CV-89-01

**STABILITY AND CONTROL TESTING OF TWO MINISTRY OF HEALTH
AMBULANCES**

Author: W. Mercer

Two Ministry of Health ambulances were tested to determine their braking, steady state and transient handling characteristics. Both vehicles were tested to their performance limits and were generally found to understeer. The understeer was different for left and right manoeuvres.

Transient tests revealed that the vehicles regained directional control with little effort when forced into a potentially destabilizing manoeuvre. The vehicles were tilt tested to 35 degrees without rollover occurring. When put through a strenuous RCMP drivers course, the vehicles were found to perform comparably to standard RCMP line vehicles once the driver became accustomed to the vehicle.

Published by: Vehicle Technology Office, June 1989, 77 pp.

CV-90-01

AGGREGATE TRUCK LOAD SHIFT EXPERIMENT

Author: J.R. Billing

A limited experiment examined the tendency of truck loads of aggregate to shift during transportation between the quarry and a truck inspection station. Four loads of aggregate, judged most likely to shift, by aggregate producers and aggregate carriers, were weighed and measured at various points during the trip. Vibration during transportation caused a general uniform downward settlement of each load. Even an abrupt stop could only move a minor quantity of the load. No significant changes in truck axle load were observed as a consequence of transportation. It was concluded that load shift was a possible, but unlikely, cause of axle overloads. The original load distribution remained the most likely cause.

Published by: Vehicle Technology Office, February, 1990, 28 pp.

CV-90-02

TRUCK WEIGHT AND DIMENSION REGULATIONS AND CONTAINERS

Authors: F.P. Nix, A.M. Clayton, J.R. Billing

This paper investigates the relationship between containers and truck size and weight regulations in Canada. The original container standards were established by the International Standards Organization in 1964. Since the early 1970s, however, truck regulations have changed significantly and this has led to the use of an increasing number of non-ISO containers. This, in turn, has resulted in suggestions for a new set of standards for large containers.

Published by: Vehicle Technology Office, July 1990, 23 pp.

CV-90-03

ASSESSMENT OF TRANSPORTABLE MOBILITY AIDS IN SEVERE DRIVING CONDITIONS

Authors: W. Mercer, J.R. Billing

A severe driving test was conducted on a vehicle containing a transportable mobility aid (a scooter) with a anthropomorphic dummy as a rider. A portion of the test was to see if the system behaved in accordance with CSA D409 Standard. The remaining portion of the test was to observe the behaviour of the system under high dynamic vehicle induced loading.

Published by: Vehicle Technology Office, August 1990, 51 pp.

CV-90-06

ON THE USE OF LIFTABLE AXLES BY HEAVY TRUCKS

Authors: J.R. Billing, F. Nix, M. Boucher, B. Raney

Allowing the use of liftable axles on heavy trucks, where the axle load is controlled by the driver, may lead to axle weight compliance problems, and eventually, result in damage to roads and bridges. The trade-off is that the use of liftable axles allows truckers to haul heavy loads relatively efficiently, which benefits shippers and consumers with a low-cost transportation service.

This paper examines the economic impact on trucking in central and Atlantic Canada of four alternative regulatory scenarios having different levels of constraint on the use of liftable axles. It finds that the cost of even the most severe measure, an outright ban, is relatively small, no more than 1.14% of total industry cost. This is because there are alternative trucks with comparable payload and operating costs, but without liftable axles, to which the freight can be diverted. A few trucking operations could be faced with hauling cost increases as high as 10-13%.

Published by: Vehicle Technology Office, December 1990, 20 pp.

DRS-81-01

THE EFFECTS OF SPECIFIC VEHICLE MAINTENANCE MEASURES ON FUEL CONSUMPTION

Author: P.S. Wood

Twenty-five employees of MTO submitted their cars for testing. Fuel consumption was measured on MTO's chassis dynamometer over the EPA Urban Dynamometer Driving Schedule, with a modified procedure to enable the testing to be completed in one day. The cars were compared to manufacturers' specifications for idle mixture, idle speed, and ignition timing, and were adjusted if necessary. A diagnosis was carried out for other faults and the fuel consumption was then remeasured. Results showed that the average reduction in fuel consumption was 3.5%. In addition, average carbon monoxide levels were reduced. In an "as received" condition, 16 out of 25 vehicles would have failed the Ontario idle emissions test. After adjustments, only three would still not have passed. A regression analysis was carried out to find a mathematical expression which would enable the amount of fuel saved to be predicted from the number and the magnitude of adjustments made.

Published by: TEMP, July 1981, 37 pp.

Participating Agency: Ministry of Energy

DRS-82-02

RESULTS OBTAINED FROM PUBLIC CLINICS HELD TO DEMONSTRATE FUEL ECONOMY MAINTENANCE

Author: A.K. Blackman

The results from two week-long clinics held to demonstrate how drivers could improve their fuel economy through proper car maintenance showed that many vehicles could improve their fuel economy through minor adjustments. For instance, three out of four cars had tires that were underinflated by 35 kPa (5 psi) or more when tire manufacturers' cold sidewall pressure ratings were used as a standard. Twenty-eight percent of these tires were underinflated by 69-97 kPa (10-14 psi) with 6% underinflated by 104 kPa (15 psi) or more. These results suggest the average driver can save approximately 4% of the fuel bill by proper inflation. Of the surveyed drivers, 99.7% reported that they were "very satisfied" or "satisfied" with the clinics.

Published by: TEMP, December 1981, 7 pp.

Participating Agency: Ministry of Energy

DRS-82-04

A STUDY TO DETERMINE THE COMBINED EFFECTS OF CAR AND DRIVER FACTORS ON FUEL CONSERVATION

Authors: A.K. Blackman, B. Deslauriers

The present study was carried out to evaluate the possible fuel savings attainable through improving a combination of the most common fuel-inefficient car factors and driver actions. Results obtained varied depending on the specific car and driver, but it was demonstrated that close to half of the fuel in each tankful can be wasted through inefficient car and driver factors.

Published by: TEMP, August 1982, 14 pp.

DRIVER AID DEVICES FOR FUEL ECONOMY

Author: A. Palm-Leis

This project investigates the background and potential usefulness of devices that help motorists to improve fuel economy by modifying their driving habits. In order to establish what MTO should be doing to promote fuel conservation from this measure, the optional courses of action are laid out. The study addresses technical state of the art concerning driver aid devices, market expectations, and introduction of devices on new vehicles. Directions to pursue and specific recommendations for MTO to consider with respect to the devices are also discussed. The data used, as compiled from various references, are usually in British units, as are the functional designations of devices such as the MPG meter.

Published by: TEMP, January 1984, 88 pp.

Participating Agency: Ministry of Energy

TVS-AP-81-105 REVIEW OF ELECTRIC VEHICLE DEVELOPMENTS 1980

Author: J. Duncan

The report reviews the state of the development of electric vehicles and their progress toward economic viability at the end of 1980. The more significant news and events are discussed and views from abroad are presented. The conclusion is that while the electric car may be inevitable, progress is slow and the development of new, cheap, very efficient midget gasoline cars may tend to postpone the time when electric cars will become viable.

Published by: Vehicle Systems, February 1981, 10 pp.

TVS-TB-82-112 A METHOD FOR ASSESSING THE LIFE-CYCLE COSTS OF DIESEL AND ELECTRIC BUSES

Authors: J. Duncan, M.D. Harmelink

World-wide concern about the future supply and price of petroleum fuel has heightened interest in alternative forms of energy. Urban transit is an area where electrical energy may be substituted for petroleum fuel. This report presents a method of analyzing various electrical and electric hybrid bus systems, taking into account the influence of bus headway and comparing their costs with those of the regular diesel bus. The method also incorporates the concepts of Value Analysis, putting into perspective the additional costs that may be associated with the use of a particular form of energy.

Published by: Vehicle Systems, July 1982, 32 pp.

TVS-AP-82-113 REVIEW OF ELECTRIC VEHICLE DEVELOPMENTS 1981

Author: J. Duncan

A number of 1981 reports and news items are reviewed and correlated in this paper in order to link the life-cycle costs of the electric vehicle (EV) with its potential marketability. Recent test data show that the EV is currently more expensive to operate than the internal combustion engine vehicle. Significant improvements in battery performance and cost are needed to enable the electric vehicle to reach a competitive level within internal combustion engine vehicles. The progress achieved in near-term battery developments is reviewed and assessed. Some governments appear to be de-emphasizing their financial support of electric passenger cars.

Published by: Vehicle Systems, July 1982, 25 pp.

TVS-83-02 LINEAR INDUCTION MOTOR: EQUIVALENT-CIRCUIT MODEL

Author: J. Duncan

An equivalent-circuit model of a linear induction motor was developed, using the rotary-motor model as a basis. The rotary-motor was modified to account for the so-called "end-effect" and has been used to predict output thrust, vertical forces and couples. These predictions are checked against test results of a practical motor used on a prototype transit vehicle.

Published by: Automotive Technology and Systems, May 1983, 7 pp.

Participating Agency: Originally printed as an article in *The Institution of Electrical Engineers Proceedings*, Vol 130, No. 1, January 1983.

TVS-83-03

ELECTROMOTIVE POWER AND LOCOMOTION

Author: J. Duncan

This paper addresses the problem of selected propulsion systems for transit vehicles. It shows that the power characteristics of the motor have a major influence on effective utilization of the power capacity. Increasing the power level brings diminishing returns in schedule speed. Generalized performance curves are developed which can be used in comparing the effect of using various power levels and motor characteristics. The significant benefits of motors that provide a constant horsepower in the field-weakening speed range is demonstrated.

Published by: Automotive Technology and Systems, May 1983, 11 pp.

Participating Agency: Originally published by The Institute of Electrical and Electronics Engineers.

EV-86-01

ELECTRIC VANS – PROGRESS REPORT

Authors: D. Hsu, J. Duncan

The Ministry of Transportation is conducting an over-the-road evaluation of two General Motors Griffon electric vans for the Ontario Centre for Automotive Parts Technology. The objective of the program is to establish an understanding of the behaviour, reliability, cost, and operational limitations of electric vehicles in routine urban traffic in Canada. This report describes vehicle preparation and testing before the vehicles were put into regular courier service.

Published by: Automotive Technology and Systems, December 1986, 56 pp.

Participating Agencies: Ministry of Energy, Ministry of Industry, Trade and Technology

EV-87-01

ELECTRIC VANS IN COURIER SERVICE: SIX-MONTH PROGRESS REPORT

Authors: D. Hsu, J. Duncan

The Ministry of Transportation is conducting an over-the-road evaluation of two General Motors Griffon electric vans for the Ontario Centre for Automotive Parts Technology. The objective of the program is to establish an understanding of the behaviour, reliability, cost, and operational limitations of electric vehicles in routine urban traffic in Canada. This report describes the first six months of vehicle operation in courier service as well as the results of this evaluation.

Published by: Automotive Technology, and Systems, September 1987, 45 pp.

Participating Agencies: Ministry of Energy, Ministry of Industry, Trade and Technology

EV-88-02

ELECTRIC VANS IN COURIER SERVICE: SECOND SIX-MONTH PROGRESS REPORT

Authors: D. Hsu, J. Duncan

The Ministry of Transportation of Ontario is conducting an over-the-road evaluation of two General Motors Griffon electric vans. The objective of the program is to establish an understanding of the behaviour, reliability, life cycle cost, and operational limitations of electric vehicles in routine urban traffic in Canada. This report describes the second six-month vehicle operation in courier service. The cumulative twelve-month operational results are given.

Published by: Vehicle Technology Office, July 1988, 64 pp.

LABORATORY REPORTS

LAB-79-04

RECOMMENDED DETECTOR LOOP INSTALLATION PROCEDURES

Author: D. Hsu

The procedure outlined in this report is recommended as a guideline for the construction of loop installations. The procedure begins with the layout of the loop and finishes at the onset of the feeder cable where connections of leads 'D' and 'E' from the M.S. plug to the feeder cable are made. This procedure may appear obvious to the more experienced staff member who has worked on loop installation. In the past, however, unacceptable installation procedures have been noticed. There will be intervals during the installation period when the outlined procedure cannot be followed. During these times, common sense should prevail.

Published by: Experimental Demonstration and Testing, August 1979, 31 pp.

LAB-80-01

DYNAMOMETER COMPUTER OPERATING MANUAL

Author: S. Skelton

This report covers the computer routines available for monitoring the dynamometer, the test cell, and for determining dynamic vehicle characteristics. Routines also allow for acquisition and analysis of data for both physical parameters and exhaust emissions. In addition, the computer is equipped to check and calibrate its own peripheral systems. To the user, the protocol and housekeeping of the system is transparent. As a consequence, the operating system is self-loading and requires a minimal contribution to the start up procedure. Program details and algorithms can be found in the *Dynamometer Computer Programming Manual*, LAB-80-02.

Published by: Experimental Demonstration and Testing, January 1980, 30 pp.

LAB-80-02

DYNAMOMETER COMPUTER PROGRAMMING MANUAL – VOLUME 1

Author: S. Skelton

The purpose of this programming manual is to offer enough background information to provide the user a basic understanding of the system. The test does not deal with its subject in great detail, but instead tries to deal with the salient points. The manual assumes the reader has programming experience. If this assumption is in error the reader may find portions difficult to follow due to lack of development. This particular volume of the manual marks the completion of the first phase of the computer system. Since it is an iterative process, the programs that are contained here will undergo a metamorphosis to keep pace with changes in the facility and to reflect the user's desires. Documentation of such changes will be issued in subsequent volumes. Some of the future changes are predicted in the System Development section at the end of the report.

Published by: Experimental Demonstration and Testing, January 1980, 50 pp.

LAB-80-06

VEHICLE DETECTOR SYSTEM STUDY PART 1: TESTING

Author: D. Hsu

This report deals with the testing of vehicle loop detector amplifiers, loop sensitivities, and loop detection characteristics. Test procedures and results are outlined and

presented. Studies on loop inductance predictions, the effects of metallic objects, and possible alternative vehicle detection systems are also discussed. The recommended installation material requirements, installation procedures, installation acceptance tests, and maintenance procedures are combined in Part 3 of the report. Discussion of specific problems, a section of conclusions, and a section of recommendations are presented in Part 1.

Published by: Experimental Demonstration and Testing, March 1980, 200 pp.

LAB-80-07

VEHICLE DETECTOR SYSTEM STUDY PART 2: RECOMMENDED TECHNICAL SPECIFICATION FOR SELF-TUNING VEHICLE LOOP DETECTOR AMPLIFIERS

Author: D. Hsu

This is Part 2 of the report on the Vehicle Detector System. It covers only one of the ten objectives of the project, the recommended technical specification for self-tuning vehicle loop detector amplifiers. The committee for the Vehicle Detector System Study agreed that the incorporation of the recommended technical specification for the self-tuning vehicle loop detector amplifiers into an MTO specification will be the responsibility of the committee for the development of MTO Traffic Signal Specifications. A section of replies to several comments made by McCormick, Rankin and Associates Limited, Consulting Engineers, is made to clear the doubts raised by the consulting firm. The specification is written so that the detector amplifier can be used in applications for both freeway surveillance and traffic actuated control systems.

Published by: Experimental Demonstration and Testing, March 1980, 25 pp.

LAB-80-08

VEHICLE DETECTOR SYSTEM STUDY PART 3: RECOMMENDED MATERIAL, INSTALLATION, ACCEPTANCE TEST, AND MAINTENANCE PROCEDURES FOR LOOP VEHICLE DETECTION SYSTEMS

Author: D. Hsu

Part 3 of the Vehicle Detector System Study project consists of three sections. Section 1 covers the recommended material requirement and installation procedure for loop constructions. It was written for MTO personnel and private contractors. Section 2 covers the acceptance criteria for loop installations. Section 3 contains the recommended maintenance procedure.

Published by: Experimental Demonstration and Testing, March 1980, 56 pp.

LAB-81-01

AN EXHAUST EMISSIONS AND FUEL ECONOMY TESTING LABORATORY FOR LIGHT VEHICLES

Author: N. Perfect

The design, construction, and operation of a small laboratory for the investigation of exhaust emissions and fuel economy of cars and other light vehicles is described. Also described are the separate systems which make up the whole facility, the major components, and the types of tests undertaken. Although the treatment is not exactly superficial, no attempt is made to go into great detail. The object is to provide a light reading rather than a weighty treatise on dynamometer design, construction, and operation.

Published by: Experimental Demonstration and Testing, May 1981, 66 pp.

LAB-81-02

DESIGN AND TESTING OF A DEMOUNTABLE STRAIN GAUGE

Author: J.W. Wagner

This report summarizes the design and testing of a transducer, together with its attachments and mounting hardware, which is used as a demountable strain gauge. The report presents simple graphs of the gauge output compared to that of electrical resistance strain gauges. Also shown are the expected errors which determine the acceptability of the transducer for its intended use.

Published by: Experimental Demonstration and Testing, July 1981, 27 pp.

LAB-82-02

NOISE EXPOSURE ASSESSMENT IN MTC SNOWPLOWS

Author: C.T. Blaney

This report presents an evaluation of the noise exposure to highway equipment operators while plowing snow. The evaluation was carried out on four trucks at two patrol yards during the months of February and March, 1982. Results indicate that the workers are not exposed to sound levels above the current Ministry of Labour regulations of 90 dBA for 8 h.

Published by: Experimental Demonstration and Testing, revised June 1983, 16 pp.

LAB-82-03

DEVELOPMENT OF A DEMOUNTABLE, RE-USABLE TRANSDUCER FOR THE MEASUREMENT OF STRAIN IN STEEL STRUCTURES

Author: J.W. Wagner

This report describes the design and testing of a demountable strain gauge used for the measurement of low dynamic strains on steel structures. The report presents simple graphs of the gauge output compared to that of electrical resistance strain gauges. Expected errors are shown, and recommendations are offered for proper use as a demountable, re-usable transducer for the measurement of strain in steel structures.

Published by: Experimental Demonstration and Testing, August 1982, 27 pp.

LAB-82-03

PERMANENT COUNTING STATIONS (PCS) MICROCOMPUTER PROGRAMMING MANUAL

Author: S. Skelton

The purpose of this programming manual is to offer enough background information to provide a user with a basic understanding of the system. The text does not deal with the subject in great detail, but, instead, tries to deal with the salient points. The manual assumes the reader has programming experience. It deals with the completion of Phase II software and features up to 16 lanes of monitoring vehicle counts, long vehicles, and speed. It does so by the manipulation of 26 routines. Of these, 10 were written directly for PCS, and the other 16 were taken from Caltrans District 11 software supplied for ramp metering. Modification to the Caltrans software ranges from minor to extensive, sometimes leaving little resemblance to the original form. Published by: Experimental Demonstration and Testing, September 1982, 199 pp.

LAB-82-04

A REVIEW OF THE SERVICE HISTORY OF THREE VOLKSWAGEN VEHICLES DURING TESTING ON METHANOL FUEL

Author: C.E. Simmons

This report provides a performance comparison of three cars which were fuelled with 100% methanol (M100). The cars included two 1981 VW Golf Sedans with 12:1 compression ratio engines, and one 1977 VW Golf Sedan with a standard engine and Bosch type fuel injection. It discusses the problem of cold engine starting using pure methanol and contamination of methanol fuel, and suggests possible solutions. For cold-weather starting, the fuel-injected 1977 Rabbit engine was equipped with a propane starting system. However, engines of this type would need an oil and filter change every 1500 km, due to the rapid depletion of the lubricating oil additives. Published by: Vehicle Systems, July 1982, 41 pp.

LAB-83-01

PERMANENT COUNTING STATIONS (PCS) MICROCOMPUTER PROGRAMMING MANUAL SUPPLEMENT

Author: S. Skelton

In the Permanent Counting Stations' onboard software, there are two distinct, but inter-dependent, areas of effort: those of computation and communication. The area of computation, documented in the September 1982 publication, "Permanent Counting Stations (PCS) Microcomputer Programming Manual" (LAB-82-03), covered concerns on the completed Phase II software. This document is a supplement to that publication; it contains changes that resulted from alterations made to the communication in December. Although these changes are minor they may cause confusion if the firmware and program documentation is scrutinized. To maintain coherence between the program listing and explanation, the page numbering of Appendix A is consistent with the numbering of the original document.

Published by: Experimental Demonstration and Testing, April 1983, 45 pp.

LAB-84-01

CHASSIS DYNAMOMETER FACILITY PROCEDURES

Author: N. Perfect

This report replaces LAB-79-05, "Dynamometer Facility Procedures," issued in November 1979. The facility has undergone major modifications since then and many of the old procedures have changed significantly. Presented are copies of each of the old procedures to be followed in day-to-day operation and maintenance of the facility and in calibration and care of the equipment. Standard methods for urban emissions and highway fuel economy tests remain unchanged and follow Transport Canada Procedures. Published by: Experimental Demonstration and Testing, April 1984, 41 pp.

LAB-84-02

CLOSED-CIRCUIT TELEVISION FOR VEHICLES

Authors: D. Hsu, C. Blamey

This report documents tests of a closed-circuit television (CCTV) system specifically designed to provide commercial vehicle drivers with a wide rearward view, a feature vital to safer operation. Testing was performed during the week of July 23, 1984. Testing was separated into two parts: part 1 was to check the operating characteristics of the CCTV system, part 2 was aimed at obtaining feedback from very experi-

enced drivers by operating both a GO-Transit bus and a MTO snowplow truck fitted with CCTV under simulated urban street conditions. This report discusses the results obtained from the tests and makes some recommendations.

Published by: Experimental Demonstration and Testing, August 1984, 17 pp.

LAB-85-01

DYNAMOMETER MANUAL CONTROL SYSTEM HARDWARE

Author: J. Chu

This hardware manual provides general information, hardware preparation and calibration, control system circuit, and support information for the Dynamometer Control System. The control system is modular in design and comprises the Motorola 6800 modules. This manual contains detailed circuit descriptions and technical data for the modules.

Published by: Automotive Technology and Systems, October 1985, 86 pp.

MUNICIPAL ENERGY

TEMP MUNICIPAL TRANSPORTATION ENERGY SEMINARS: SUMMARY OF PROCEEDINGS

The Municipal Transportation Energy Seminars were held across the province between April and June 1980 to inform municipalities of the need for energy conservation and make them aware of the conservation opportunities available to them. This report

summarizes the presentations and discussions of the seminars.
Published by: TEMP, May 1981, 95 pp.

TEMP TRAFFIC MANAGEMENT MEASURES TO REDUCE ENERGY CONSUMPTION

This report guides and assists municipalities in the development, evaluation, implementation, and monitoring of traffic operations measures to reduce energy consumption. Improved signal timing, flashing of signals and reversible lanes are some of the measures discussed through the use of charts, diagrams, and case studies.
Published by: TEMP, November 1981, 36 pp.

TEMP ALTERNATIVE WORK SCHEDULES STUDY

This report documents the findings and conclusions from the Alternative Work Schedules Study carried out in 1981. The study illustrates the extent to which alternative work schedules can contribute to energy savings in Ontario.
Published by: TEMP, 1982, 38 pp.

TEMP SURVEY: TRANSPORTATION AND ENERGY CONSERVATION IN ONTARIO MUNICIPALITIES

Volume 1: Summary

In 1981 a questionnaire was administered to all Ontario municipalities concerning characteristics relevant to energy problems, local perceptions of these problems, and the action taken by municipalities. The study categorizes the transportation-related energy activities and provides an indication of these activities. This part of the report summarizes the main findings of the survey. (31 pp.)

Volume 2: Appendix

This report provides a detailed look at the 1981 questionnaire. It describes the survey method and the findings, question-by-question and measure-by-measure. (159 pp.)
Published by: TEMP, 1982

TEMP TEAM SEMINARS EVALUATION REPORT, 1982

During the spring of 1982, a series of Municipal Transportation Energy Seminars were presented by the Municipal Transportation Energy Advisory Committee (MTEAC). This report is an evaluation of the seminar sessions, with items such as seminar locations, format, scheduling, and seminar content being studied.
Published by: TEMP, 1982, 250 pp.

TEMP **GUIDELINES FOR PREFERENTIAL TREATMENT FOR HIGH-OCCUPANCY VEHICLES**

This report gives a detailed look at high occupancy vehicle (HOV) lanes. Topics such as HOV projects and policies are explained in a comprehensive, step-by-step manner. Published by: TEMP, 1982, 62 pp.

TEMP **TEAM SUMMARY BOOKLETS**

The purpose of these booklets is to provide a summary of the main points of the Transportation Energy Analysis Manual in non-technical language for non-technical people. The titles of the booklets are: Energy Conservation Through Fleet Management; Energy Conservation Through Road Construction and Maintenance; Energy Conservation Through Traffic Management; Energy Conservation Through Transit and Ridesharing; Energy Conservation Through Travel Demand Management; Energy Conservation Through Transportation Program Management; and Energy Conservation Through Municipal Management: An Overview of Opportunities for Small Municipalities.

Published by: TEMP, 1983

TEMP **1981 EMPLOYEE TRAVEL HABITS – MUNICIPAL RESPONDENTS**

Author: J. Bylok

Time series information on travel behaviour, travel related attitudes and automobile utilization is highlighted in this report based on the 1981 survey. Several charts are used to fully explain the questions administered to municipal employees in Ottawa, Sault Ste. Marie, Waterloo and Niagara.

Published by: TEMP, January 1983, 144 pp.

TEMP **TRANSPORTATION ENERGY ANALYSIS MANUAL 1982/83**

The purpose of the Transportation Energy Analysis Manual (TEAM) is to guide municipal decision-makers and transportation professionals to those actions which can effectively reduce energy consumption within their municipality. The manual is organized into 10 chapters and outlines the principal technical considerations to conserve energy through transportation improvements. The cost of this manual is \$30. The chapters cover the following topics: 1) Overview and Summary; 2) Street-System Operation; 3) Transit Service; 4) Ridesharing; 5) Travel Demand Management; 6) Municipal Fleet Management; 7) Road Construction and Maintenance; 8) Contingency Planning; 9) Municipal Energy Program Management; and 10) Energy Analysis Manual.

Published by: TEMP, March 1983, 246 pp.

TEMP **MUNICIPAL FLEET MANAGEMENT INFORMATION SYSTEM (MFMIS)**

A stand-alone, microcomputer-based software package was designed to assist municipalities in fleet management. System features include parts inventory, inventory control, vehicle maintenance, replacement scheduling, and fuel economy overtime, as well as a number of additional functions which aid fleet management. System docu-

mentation includes a System Description, an Implementation Handbook, a User Manual, a Production Manual, and two volumes of Systems Manuals. The system software is also included.
Published by: TEMP, 1985

More information on the Municipal Program is available by contacting the Transportation Energy and Productivity Office (TEPO). A catalogue of its publications on transportation energy conservation opportunities is available, free of charge, on request:

TEPO
Central Building, Room 324
Ministry of Transportation
1201 Wilson Avenue
Downsview, Ontario
Canada M3M 1J8
(416) 235-5037

- 1975 **URBAN RAIL VEHICLE RUNNING GEAR: A STATE OF THE ART REVIEW**
Author: R.A. Curmi
- 75-TIL-3 **TRACK STIFFNESS ANALYSIS**
Author: J.R. Gandier
- TS-TR-75-104 **RAILWAY NOISE – STATE OF THE ART**
Author: G.L. Elliott
- 1975 **LATERAL STABILITY AND CURVING CHARACTERISTICS OF URBAN RAIL VEHICLES**
Author: J.A. Young
- TS-TR-75-110 **LATERAL DYNAMICS OF LIGHT RAIL VEHICLES**
Author: J.A. Young
- 1975 **STABIL: PROGRAM TO ANALYSE THE LATERAL STABILITY CHARACTERISTICS OF RAIL VEHICLES**
Author: J.A. Young
- 1976 **APPLICATION OF GRAVITATIONAL ENERGY EXCHANGE TO TRACKED URBAN TRANSIT SYSTEMS**
Authors: T.A.P.S. AppaRao, V. Soots, J.R. Billing
- 1976 **ELEVATED GUIDEWAY CONCEPTS FOR LIGHT RAIL TRANSIT**
Authors: R.A. Dorton, H.N. Grouni, J.R. Billing
- 1976 **DETAILED PROPOSAL FOR DESIGN OF A WHEEL/RAIL INTERACTION SIMULATION (WRIS)**
Author: R. A. Curmi
- 1977 **WHEEL-RAIL PROFILE INVESTIGATION**
Author: J.D. Jackson
- 1977 **MODELS FOR SIMULATION OF THE DYNAMICS OF CURVE ENTRY OF A RAIL TRANSIT VEHICLE**
Author: T.A.P.S. AppaRao

-
- 1977 **DESIGN OF ELEVATED GUIDEWAY STRUCTURES FOR LIGHT RAIL TRANSIT**
Authors: H.N. Grouni, J.R. Billing
- 1977 **LATERAL DYNAMICS OF STEERED TRUCKS**
Authors: J.A. Young, M.G. Gray
- 1978 **PRELIMINARY DYNAMIC TESTING OF THE ICTS KINGSTON ELEVATED GUIDEWAY**
Author: J.R. Billing
- TS-TR-78-111 **VIBRATION PROPERTIES OF TWO RING DAMPED TTC RAILWAY WHEELS**
Authors: L. Strasberg, J. Tiessinga
- TS-TR-78-101 **APPLICATION OF RANDOM DATA ANALYSIS IN INVESTIGATING RAIL WHEEL NOISE AND VIBRATION – PRELIMINARY TTC MEASUREMENTS**
Author: M.M. Osman
- 78-TIL-6 **WRIS: INSTRUMENTATION AND DATA ACQUISITION**
Author: S. Skelton
- TS-TR-78-110 **DIGITAL SIMULATION OF THE CURVE ENTRY DYNAMICS OF A RAIL TRANSIT VEHICLE**
Author: T.A.P.S. AppaRao
- TS-TR-78-103 **AN ASSESSMENT OF THE PARAZADER GUIDEWAY CONCEPT**
Authors: J.R. Billing, H.N. Grouni, D.F. Conte
- TVS-TR-79-123 **INTERIM INPUT AND RUN INSTRUCTIONS FOR TEST DATA ANALYSIS PROGRAM TEDANA**
Authors: J.R. Billing, T.A.P.S. AppaRao
- 1979 **WHEEL AND RAIL PROFILE MEASUREMENTS FOR URBAN RAIL TRANSIT SYSTEMS**
Author: J.D. Jackson

LAB-79-03

**INVESTIGATION OF STABILITY AND CURVING OF A RAIL TRANSIT VEHICLE
VOLUME 2: INSTRUMENTATION AND TESTING**

Authors: D. Hsu, S. Skelton

This report is a record of the instrumentation, data acquisition, and data retrieval of the rail transit vehicle truck test. A total of three tests were conducted in which 20 parameters were measured or monitored simultaneously. Test data were recorded first, and were transformed into three usable forms, namely, the time history/plot, the digitized IBM compatible tape, and the power spectral density plot. These usable data were then analyzed and reported by the project officers. A discussion of the problems encountered and a section of the conclusions and recommendations are presented.

Published by: Experimental Demonstration and Testing Office, July 1979, 91 pp.

TS-79-101

**INVESTIGATION OF STABILITY AND CURVING OF A RAIL TRANSIT VEHICLE
VOLUME 4: NONLINEAR CURVING MODEL**

Author: T.A.P.S. AppaRao

The Curve Entry Dynamics Model, developed at MTO, was upgraded by including two new features: nonlinear wheel/rail geometry and friction at side bearers. Both these features are considered important when the vehicle traverses a short radius curve. The vehicle's equations of motion are presented and changes required for different features selected are indicated. Appropriate changes are made to the Curve Entry Dynamics Program to implement the new features. As before, all the model features are available as options in the program, so that the user may select a desired set of these.

Published by: Vehicle Systems, February 1979, 81 pp.

1980

POINT IMPEDANCES OF RAILWAY WHEELS

Authors: L. Strasberg, J.P. Tiessinga

The radial point impedances of several transit type railway wheels are presented in this paper. The results were obtained by impact methods with the aid of a Fast Fourier Transform Analyzer. A new A28 railway wheel and one worn to a 25-inch diameter were investigated. Four resilient wheels were also tested.

The implication of these impedances, and especially the presence of resonant modes, on the dynamic system being used to predict rolling noise is discussed.

Published by: Transit Systems, Research and Development Division, April 1980, 18 pp.

1980

AIR CUSHION ICE-BREAKER ATTACHMENTS FOR WINTER FERRY OPERATION

Author: D.G. Hobbs

This informational presentation covers the results of an investigation that was prompted by the possible need for winter ferry service at Pelee Island and discusses Air Cushion Icebreaker Bow (ACIB) technology.

July 1980, 13 pp.

TS-80-101

THE ICTS GUIDEWAY TEST PROGRAM

Authors: J.R. Billing, J.W. Wagner, J. Tiessinga

This report presents that portion of the Intermediate Capacity Transit System (ICTS) Phase 3 Guideway Test Program conducted by Canadair Services Ltd. (CSL) using the resources of MTC. Eleven tests are reported, numbered GW04TE, GW06TE, GW07T3, GW11TE, GW12TE, GW16TE, GW17TE, GW19TE, GW20TE, AND GW25TE in the ICTS Program Integrated Test Plan prepared by CSL, together with some added ground-borne vibration measurements requested by CSL. The tests were conducted in separate sessions in February, April, and October 1979 at the Transit Development Centre (TDC). The objectives, instrumentation, procedure, and results of each test are presented, together with some discussion of the results.

Published by: Research and Development Division, March 1980, approx. 300 pp.

TS-TR-80-111

CURVING BEHAVIOUR OF RAIL TRANSIT VEHICLES: A PARAMETRIC STUDY

Author: T.A.P.S. AppaRao

Using a digital computer model, the steady state curving behaviour of a rail transit vehicle is examined for a wide range of values of a number of vehicle parameters. The results, shown here in the form of plots and charts, are expected to be of considerable use in vehicle design.

Published by: Research and Development Division, June 1980, 5 pp.

1980

A PRELIMINARY REPORT ON THE APPLICABILITY OF AN AIR CUSHION ICE BREAKER BOW ATTACHMENT FOR WINTER OPERATION OF FERRY BOATS

Author: T.A.P.S. AppaRao

This report summarizes the findings to date by the author on the applicability of an Air Cushion Icebreaker Bow (ACIB) attachment for winter operation of ferry boats at Pelee Island. From the information available so far, it appears that the ACIB concept has the potential of offering a relatively inexpensive solution to the difficult problem of winter operation of ferries.

Published by: Transit Systems R & D Office, Research and Development Division, May 1980, 16 pp.

TVS-TR-81-106

INTERIM REPORT ON RAIL LOAD MEASUREMENTS ON TANGENT TRACK

Author: J.R. Billing

This interim report is presented to the MTC/TTC Subway Car Truck Investigative and Development Program Steering Committee to make the results available in advance of a formal report. This report covers only the tangent track load measurements at Yorkdale and Pape-Donlands; the curved track data at St. George is still being processed.

Published by: Transport and Vehicle Systems R/D, Research and Development Branch, January 1981, 11 pp. and appendices.

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- 1981 **LATERAL DYNAMICS OF A RAIL TRANSIT VEHICLE:
A COMPARISON OF EXPERIMENTAL AND THEORETICAL RESULTS**
Author: J.A. Young, T.A.P.S. AppaRao
- This paper describes some of the recent experimental and analytical work carried out by the authors on the lateral dynamics of a rail transit vehicle.
Published in: *Journal of Dynamic Systems, Measurement, and Control*, March 1981, 10pp.
- 1982 **PRELIMINARY RESULTS FROM PROTOTYPE TRUCK TESTS**
Author: T.A.P.S. AppaRao
- Two H1 subway cars, equipped with retrofitted trucks were tested over 10 days in June 1982. These tests were, in many respects, similar to the Baseline Tests conducted in December 1981 on the same cars but equipped with unmodified trucks. This report compares the results obtained from the two tests. While much test data remains to be analyzed, the results reported here provide convincing evidence that the retrofit suspension is successful in eliminating hunting and improving ride.
Published by: Policy Planning and Research Division, August 1982, 28 pp.
- TVS-TR-82-103 **ANALYSIS OF SUSPENSION CHANGES TO IMPROVE DYNAMIC BEHAVIOUR
OF TTC PRE-H4 SUBWAY CARS**
Author: T.A.P.S. AppaRao
- This report describes analyses conducted to determine the suspension changes required for the TTC pre-H4 subway cars in order to eliminate hunting behaviour and ensure stability and curving. Two retrofit designs, both involving changes to primary longitudinal and lateral stiffnesses, have been identified. The pre-H4 car retrofitted with either of these two designs is found to possess satisfactory stability and curving comparable to that of the H4 car. The sensitivity of these designs to manufacturing errors is found to be small. Guidelines are given for hardware implementation to ensure that the truck retrofit will perform well in all operating conditions and will have no undesirable side-effects.
Published by: Policy Planning and Research Division, November 1982, 66 pp.
- 1983 **COMPUTER-AIDED ANALYSIS OF RAIL VEHICLE DYNAMICS**
Authors: T.A.P.S. AppaRao, J.R. Billing
- This paper describes several computer models applicable to rail vehicle suspension analysis and design. All of them are based on a general purpose program, DYN SYS, which has greatly facilitated model development.
Published by: Transportation Technology and Energy Division, 1983, 8 pp.
- 1983 **DYNAMIC STABILITY OF SUBWAY CARS: ANALYSIS, DESIGN AND TESTING**
Authors: T.A.P.S. AppaRao, W.H. El Maraghy
- A peculiar periodic gauge face wear found on the Toronto subway tracks has been diagnosed and experimentally confirmed as being due to the hunting oscillations of older cars in the fleet. This paper discusses the dynamic analysis that were conducted to identify primary suspension changes needed to improve their stability and to insure satisfactory curving behaviour.
1983, 14 pp.
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1984

DYNAMIC ANALYSIS OF THE GO-ALRT VEHICLE: PRELIMINARY REPORT ON VERTICAL DYNAMIC ANALYSIS OF THE MCLST-CONFIGURED TEST VEHICLE

Author: D.K.W. Leung

This report discusses an analysis programme that was conducted on the GO-ALRT test vehicle configured with two MCL List Concept Rotary Powered Steerable Trucks and subjected to random excitations due to vertical track roughnesses. The objective was to predict ride quality and provide analytical data on track force spectral distributions to assist in an assessment of potential ground-borne vibration problems once testing of the GO-ALRT track system is finalized and its track/ground dynamic characteristics become available.

Published by: Transportation Technology Office, May 1984, 60 pp.

1984

DYNAMIC ANALYSIS OF THE GO-ALRT VEHICLE: PRELIMINARY REPORT ON LATERAL STABILITY ANALYSIS

Author: D.K.W. Leung

This report concerns investigation of the lateral stability performance of the two candidate steerable trucks for the GO-ALRT vehicle. These trucks are the List Concept Rotary Powered Steerable Trucks, designed by Metro Canada Ltd., and the Floating Frame Steerable Truck, designed by Urban Transportation Development Corporation, Research and Development.

Published by: Transportation Technology Office, June 1984, 41 pp. and appendices.

VS-84-01

RIDE QUALITY OF ONTARIO NORTHLAND RAIL CAR #1987-A

Authors: D. Hsu, J. Turner

This report documents the ride quality of car #1987-A of ONTC's TEE-Train, measured over three different sections of ONR track. The three sections comprise one smooth tangent, one fair tangent, and one curve. Ride quality was measured in the vertical and lateral directions of the A-car, first in the forward end over the truck and then at the centre of the car. The train was run over each of the three sections of track at least six times – three with the ride-measuring equipment forward and three with the equipment at the centre.

Published by: Vehicle Systems, December 1983, 25 pp.

TT-UR-84-01

RIDE QUALITY OF ONTARIO NORTHLAND TEE-CAR AND GO TRANSIT SINGLE AND BI-LEVEL CARS

Authors: J.E. Turner, T.A.P.S. AppaRao, D. Hsu, J. Tiessenga

Ride quality testing was performed on three rail cars – the ONTC TEE-Train, GO Transit single level, and GO Transit bi-level cars – to determine their relative ride characteristics. Accelerometer signals were recorded aboard the cars over three different track types (differing ride characteristics). These signals were then processed and ISO analysis performed to determine the "Reduced Comfort" ride quality for different positions in each test car over each piece of test track. Two British Rail ride meters were used to provide reference information. A detailed mode shape analysis was also performed on the bi-level car only, to investigate upper deck dither.

Published by: Automotive Technology and Systems, June 1984, 98 pp.

Participating Agencies: Toronto Transit Commission, Can Car Rail Inc., Ontario Northland Transportation Commission (ONTC), and GO Transit.

1984

DYNAMIC ANALYSIS OF THE GO-ALRT VEHICLE: PRELIMINARY REPORT ON VERTICAL DYNAMIC ANALYSIS OF THE FLOATING FRAME STEERABLE TRUCK CONFIGURED TEST VEHICLE

Author: D.K.W. Leung

This report discusses an analysis programme that was conducted on the GO-ALRT test vehicle configured with two MCL List Concept Rotary Powered Steerable Trucks and subjected to random excitations due to vertical track roughnesses. The objective was to predict ride quality and provide analytical data on track force spectral distributions to assist in an assessment of potential ground-borne vibration problems once testing of the GO-ALRT track system is finalized and its track/ground dynamic characteristics become available.

Published by: Transportation Technology Office, September 1984, 13 pp. and appendices.

RT-85-01

DYNAMIC ANALYSIS OF THE GO-ALRT VEHICLE: AN EXECUTIVE SUMMARY

Author: D.K.W. Leung

This report provides a summary of an analysis programme that was initiated in the fall of 1983 by the ministry, at the request of GO-ALRT, to provide an independent analytical prediction of the dynamic performance of two steerable truck concepts that were being proposed and designed by Metro Canada Ltd. and UTDC Research and Development Ltd.

Published by: Rail Technology and Systems Office, October 1985, 10 pp.

RT-85-02

DYNAMIC ANALYSIS OF THE GO-ALRT VEHICLE – A FINAL REPORT

Author: D.K.W. Leung

This report discusses an analysis programme that was initiated in the fall of 1983 by the ministry, at the request of GO-ALRT, to provide an independent analytical prediction of the dynamic performance of two steerable truck concepts that were being proposed and designed by Metro Canada Ltd. and UTDC Research and Development Ltd.

The report concludes that, in view of the various performance deficiencies exhibited by both steerable trucks, design improvements need to be made to these trucks before they are considered for production applications under the GO-ALRT vehicle. It is also recommended that a technique be developed for a more realistic and accurate evaluation of the true transient curving response for the two trucks on the actual GO-ALRT alignment.

Published by: Rail Technology and Systems Office, October 1985, 130 pp.

RT-87-01

ADVANCED LIGHT RAPID TRANSIT – A CANADIAN ACHIEVEMENT

Author: T.A.P.S. AppaRao

The Advanced Light Rapid Transit (ALRT) System has been developed in Canada to provide a cost-effective, versatile, environmentally acceptable, and high-quality service solution for medium-capacity transit applications. The potential of this new technology is now being explored and expanded. This paper provides an objective overview of the ALRT technology, the history of its development, descriptions of the three existing ALRT systems, and the future of this technology.

Published by: Rail Technology and Systems Office, September 1987, 16 pp.

RATSO-90-01

BI-LEVEL III RIDE QUALITY IMPROVEMENT PROGRAM FINAL REPORT

Prepared by: UTDC Inc.

VOLUME 1 – Simulation Report: The objective of the program was to improve the vertical ride quality of the GO Transit Bi-level passenger car upper deck. A series of nine vertical dynamic models was developed to represent the car and possible low-cost methods to improve the ride. Each model was run to predict the natural frequencies and modes, and the response to random vertical and cross-level track impact. As well, a 1/4 car ANSYS-based finite element model was derived and used to assess the effect upon model frequencies and relative acceleration (pseudo-acceleration) of the various methods proposed to improve the vertical ride quality.

VOLUME II – Test Report: Three proposed modifications to the car were designed and fabricated: a) stanchions connecting upper and lower decks, b) vibration absorber, and c) secondary damper link bush modification. Initial tests were carried out to measure the ride quality of a sample of cars in the fleet to establish a baseline. The modifications were installed in a car and were initially tested statically with an impact hammer, then dynamically over characteristic track sections. Transducers (both vertical and lateral) were used to measure accelerations on both the upper and lower deck.

Published by: Rail and Advanced Transportation Systems Office, March 1990, approx. 250 pp.

RATSO-90-02

COMMUTER RAIL COAST ADVICE SYSTEM – PHASE 1 AND 2

Author: P.J. Pudney, B.R. Benjamin, G.W. English

A fuel conservation system, consisting of software and hardware developed by the South Australian Institute of Technology for use on commuter rail trains, was tested on a four-car GO Transit commuter train. The device advises the engineperson to apply power, coast, or brake in order to operate the train in a fuel-efficient manner while maintaining the prescribed schedule. The test was conducted on a train operating in revenue service on the Lakeshore line, which is 60 km in length. The device worked effectively, resulting in fuel savings of 10% and traction energy savings of 20%.

Published by: Rail and Advanced Transportation Systems Office, March 1990, 38 pp.

RT-91-01

LABORATORY EVALUATION OF A PROTOTYPE VISION SYSTEM FOR AUTOMATED RAIL PROFILE MEASUREMENT

Author: D.K.W. Leung

A prototype vision system for measuring rail profiles was tested for data consistency and accuracy on a section of test track.

This report presents the test results and discusses several areas where the effectiveness and performance of the system can be enhanced with a few improvements. The report concludes that a vision-based rail profile measuring system will provide an efficient and effective alternative to conventional rail profile measurement methods. Recommendations are also made regarding future work.

Published by: Rail and Advanced Transportation Systems Office, February 1991, 47 pp.

FIELD TESTING OF A PROTOTYPE VISION SYSTEM FOR RAIL PROFILE MEASUREMENT

Author: D.K.W. Leung

A prototype vision system for measuring rail profiles was tested on a section of the TTC subway system. The measurements made with the vision system were compared to those manually obtained by TTC using a conventional profilometer.

The report presents the vision-based and manual measurement data and the associated findings and concludes that the vision-based measurements compared very well with the manual counterpart in accuracy. Recommendations are also made regarding future work.

Published by: Rail and Advanced Transportation Systems Office, February 1991, 47 pp.

RIDESHARING

- TVS-83-01 **THIRD-PARTY VANPOOL PROGRAM: A REVIEW OF U.S. EXPERIENCE AND THE DEVELOPMENT OF A SUITABLE OPTION FOR ONTARIO**
Authors: B. Haigh, G. Allen

A third-party vanpool program is defined as one in which an agency, other than an employer or an employee association, supplies vans and associated services to groups of individuals. The agency is designed to serve smaller companies which do not have the resources to sponsor their own programs, and groups of individuals who wish to form a vanpool independently. This report examines the current third-party vanpool programs in the U.S. and develops a suitable option for Ontario. All U.S. programs are examined in detail, suitable options are developed and evaluated, and an appropriate program is recommended.
Published by: TEMP, January 1983, 114 pp.

- TVS-AP-81-108 **MTC VANPOOL DEMONSTRATION**
Author: P. Dalton

The report describes all aspects of the development, operation, and evaluation of the demonstration including comprehensive revenue and cost data. The demonstration proved successful in meeting all of its original objectives despite initial ridership in the pools being lower than expected. Administrative procedures were kept as simple as possible, with existing accounting and administrative processes within MTC utilized where possible.
Published by: TEMP, February 1981, 80 pp.

- TVS-AP-81-113 **THE DEVELOPMENT OF THE RIDESHARING PROGRAM IN ONTARIO**
Authors: P. Dalton, B. Deslauriers

To enable the development of a ridesharing program in Ontario, a general action plan was developed involving the evaluation and preparation of proposals for the staged introduction of a number of different service options in their appropriate settings. There are three phases to the plan. Phase I involved the assessment of different modes of paratransit outside of Ontario, the opportunities in Ontario, and legal and regulatory barriers to implementation. Phase II of the plan involved pilot demonstrations in car- and vanpooling and further studies of specific opportunities identified in Phase I for shared-ride taxi operations, priority treatment of high occupancy vehicles, and the use of peripheral parking lots to encourage commuter transit services and car- and vanpooling. Phase III of the plan will be general implementation.
Published by: TEMP, 1981, 55 pp.

- TEMP **THE STATUS OF WORKER BUS OPERATIONS IN ONTARIO**
Authors: G. Allen, B. Haigh

This report was prepared to determine the status of worker bus operations in Ontario and to identify the expansion opportunities within the province. The report includes a detailed review of worker bus operations by sponsorship group and an examination of

the legal aspects, costs, and benefits associated with these services. The study revealed that a total of 164 vehicles were operating on the 67 routes investigated. Worker bus services were organized by five different types of sponsors: employer, owner operator, employee group, bus company, and transit authority. Due to the existing worker buses in the province, annual travel cost savings are about \$20 million. Published by: TEMP, May 1984, 44 pp.
Participating Agency: Ministry of Energy

EC-86-01 **SHARE-A-RIDE RIDESHARE MATCHING SYSTEM (SARRMS)
OPERATORS MANUAL**

SARRMS is an on-line, interactive rideshare matching system specifically designed for Canadian applications. SARRMS is flexible enough to be used by employers, municipalities, and ridesharing agencies to provide rideshare matching services. It requires only limited knowledge of computers, and this manual gives detailed operational instructions for every aspect of the system.
Published by: TEMP, October 1986, 84 pp.

TEMP **SHARE-A-RIDE RIDESHARE MATCHING SYSTEMS (SARRMS) SYSTEM
DESCRIPTION**

SARRMS is an on-line, interactive rideshare matching system specifically designed for Canadian applications. It produces up-to-the-minute, personalized matching information for rideshare applicants. This brochure describes the features, hardware requirements, and software of SARRMS. A system structure overview is provided and the various programs are discussed.
Published by: TEMP, February 1987, 10 pp.
Participating Agency: Ministry of Energy

TEPP-89-01 **EMPLOYER-SPONSORED VANPOOLING IN ONTARIO – 1989 INVENTORY**
Author: R. Chisholm

To determine the extent of vanpooling's diversity among employer-sponsored programs, Share-A-Ride conducted a survey of Ontario's vanpool administrators in early 1983 and has updated it four times since then. The inventory is an excellent source on material for companies considering implementing a vanpool program and provides current operators with the opportunity to exchange information about their programs.
Published by: Transportation Energy and Productivity Office, June 1989, 48 pp.

TEPP-91-00 **CARPOOL PARKING LOTS INVENTORY – NOVEMBER 1990**
Author: R. Chisholm

The annual inventory of carpool parking activity in Central and Eastern Ontario is conducted each November. Surveyed are official MTO parking lots, unsigned parking areas, and official municipal parking lots. The inventory includes features such as signs, facilities and vehicle counts. There are 49 official MTO parking lots containing a total of 2830 parking spaces. The average overall occupancy was calculated to be 59%.
Published by: Transportation Energy Office, January 1991

TELECONFERENCING

TC-83-01

SURVEY OF TELECONFERENCING USE IN ONTARIO

Author: Abt Associates of Canada

This study consisted of interviews conducted by telephone with 307 companies in Ontario. The companies were randomly selected from a Dun & Bradstreet listing consisting of Ontario firms (excluding government organizations) with corporate headquarters in Ontario, more than one establishment, and more than 250 employees. The ideal respondent at each company was an individual with knowledge of his or her company's business travel and telecommunications, both from an operational and policy perspective. In cases where these functions were managed by two different people, both company representatives were interviewed.

Published by: TEMP, March 1983, 52 pp.

Participating Agency: Ministry of Energy

TEMP

TELECONFERENCING USER'S MANUAL

The Ontario government encourages teleconferencing as a substitute for business travel whenever possible. To this end the government has invested in teleconferencing equipment and systems which are described in this booklet. This booklet introduces the teleconferencing services available within the Ontario government and provides tips on how to prepare for and conduct a successful teleconference.

Published by: TEMP, March 1983, 33 pp.

Participating Agency: Ministry of Energy

TEMP

TELECONFERENCING PROGRAM GUIDE

This guide is designed to assist in establishing a teleconferencing program within your organization. Our experience has indicated that the success of teleconferencing rests, to a large extent, on following a well-developed program plan. Close attention must be paid to human factors as well as technological ones. In order to provide assistance in this area, this implementation guide includes the following sections: Feasibility Study, Senior Management Support, Assessing Potential Teleconferencing User Needs, System Administration and Operations, Training, Promotion, and Evaluation.

Published by: TEMP, July 1983, 30 pp.

Participating Agency: Ministry of Energy

TEMP

TELECONFERENCING TRAINING GUIDE

This manual focusses on the human dimension of teleconferencing and is designed to assist in developing training programs for potential users. Without adequate information and training, a user may have an unsuccessful first experience with this medium and develop a negative attitude towards teleconferencing. Thus the coordinator, who is responsible for training, becomes vital to the success of teleconferencing in a particular organization or company. The training techniques outlined in this manual are designed to ensure that a user's initial introduction to teleconferencing is positive.

Published by: TEMP, September 1983, 22 pp.

Participating Agency: Ministry of Energy

TEMP

TELECONFERENCING AT THE MINISTRY OF THE ENVIRONMENT

Summarized in this report are the teleconferencing activities within the Ministry of the Environment between October 1980 and December 1983. It also includes the results of a survey of the ministry's teleconferencing users conducted by the TEMP Teleconferencing Task Force in August, 1983.

Published by: TEMP, March 1984, 30 pp.

Participating Agency: Ministry of Energy

TEMP

TELECONFERENCING SYSTEMS GUIDE

A wide range of teleconferencing systems are available to meet the needs of organizations. Once the feasibility of teleconferencing has been established and organizational constraints have been identified, various system components must be chosen. First, a general decision must be made regarding the type of teleconferencing required. Visual support and full motion video are available to augment audio teleconferencing. This guide is designed to provide a brief introduction to the components of a teleconferencing system and to issues which should be considered in selecting them, and includes a list of known suppliers.

Published by: TEMP, revised February 1985, 34 pp.

Participating Agency: Ministry of Energy

TEMP

TELECONFERENCEING TECHNOLOGY AND APPLICATIONS IN CANADA

Authors: W. Cukier, B. Bell, L. Truuvert

This report provides an in-depth survey of several applications of teleconferencing, including business (with case studies), government, health, and education applications. The costs, benefits, availability, and potential of the teleconferencing technology are evaluated within the context of each application.

Published by: TEMP, November 1985, 143 pp.

Participating Agency: Ministry of Energy

EC-86-02

TELEWORK - A STATUS REPORT

Authors: W. Cukier, L. Truuvert

Telework refers to the use of telecommunications/information technology to permit individuals to work away from their place of employment. The substitution of telecommunications technology for transportation has potentially wide-ranging impacts on energy consumption, industrial organization, economy, and society. This report examines these impacts and considers advantages and disadvantages, implementation issues, and factors affecting the adoption of telework. Several case studies are presented.

Published by: TEMP, December 1986, 22 pp.

Participating Agency: Ministry of Energy

TRANSPORTATION CONTROL TECHNOLOGY

- TCT-85-01 ACTIVE VISION SENSOR TECHNOLOGY APPLICATIONS – FINAL REPORT**
Authors: J. Tsai, A.K. Ghosh, F.G. Warren, B. Davis, L. Paul

This report is a review of the state of the art in active vision sensor technology and, in particular, microwave/millimetre wave radar sensors, laser radar sensors, and sonar sensors. Two main areas for application are assessed: object identification on the guideway, and guidance and control of stationary or moveable robots for inspection and cleaning.

Published by: Transit Control Technology and Systems, August 1985, 238 pp.

- TCT-86-01 CONCEPTUALIZATION OF A MOBILE ROBOT FOR CLEANING OF TRANSIT VEHICLES**
Author: C. Jaluba

The conceptualization and design of an autonomous robotic cart equipped with two controllable cleaning tools is described. The following areas are addressed: selecting dc gearmotors, including the dynamic equations of the robot; cart control system and theory of operation of the robot; motion control, including trajectory planning and kinematic equations of the mobile cart and the cleaning tools, with consideration given to the task of cleaning rounded corners. More work is planned on the trajectory error correction and guidance system software to be carried out at a later date.

Published by: Transit Control Technology and Systems, December 1986, 71 pp.

- TCT-86-02 WIDE AREA VEHICLE MONITORING (WAVM) SYSTEM PROJECT FOR ONTARIO'S TRUCKING INDUSTRY**
Author: J. Tsai

The WAVM system is an application of satellite navigation and communications technologies. It is conceptually a computerized vehicle monitoring and management system capable of operating from coast to coast and providing two-way communications between a truck and its base station. MTO has initiated a WAVM system project to promote the system's applications by the Ontario trucking industry. A joint project group consisting of trucking companies, high technology service, and equipment suppliers, and MTO has been planned and organized. This paper describes the WAVM project background, current status and efforts, and the preliminary results.

Published by: Transit Control Technology and Systems, December 1986, 40 pp.

- TCT-87-01 USE OF ULTRASONIC SENSORS ON MOBILE CLEANING ROBOTS**
Authors: W. Wiercienski, M. Hunter

A mobile robot project was established to design a completely autonomous vehicle to aid in the daily vacuuming and washing of transit vehicles, in particular, subway cars. A major portion of this job includes the design of a guidance system. The primary task of this guidance system is to recognize the robot's location in the environment and its orientation with respect to its surroundings. This report studies the technology and problems associated with using ultrasonics as the main component of the guidance system.

Published by: Transit Control Technology and Systems, April 1987, 147 pp.

TCT-88-01 **TRENDS IN ELECTRONIC VEHICLE MONITORING TECHNOLOGY (EVMT) APPLICATIONS**
Author: J. Tsai

New electronic technologies such as mobile satellites, cellular radios, vehicle location and navigation, vehicle on-board microcomputers, artificial intelligence, automatic vehicle identification (AVI), automatic vehicle classification (AVC), and weigh-in-motion (WIM), have quickened the pace of technology applications in the transportation sector. The transportation industry favours the use of EVMT (Electronic Vehicle Monitoring Technology) to improve fleet management, vehicle dispatch, and vehicle productivity, while government agencies are interested in collecting and streamlining vehicle data, enhancing highway engineering and design, and improving traffic flow. This report reviews the current and emerging electronic vehicle monitoring technology applications being contemplated, and describes an interface concept to integrate electronic vehicle monitoring systems for future applications.

Published by: Transit Control Technology and Systems, January 1988, 18 pp.

TCT-88-02 **ROBOTIC CLEANING OF TORONTO TRANSIT COMMISSION SUBWAY CARS: A FEASIBILITY STUDY**
Authors: W. Wiercienski and Alan R. Leek

This report details the findings of a feasibility study of the use of a computerized robotic system to clean the undersides of TTC subway cars. The benefits of the robotic system include better quality of cleaning, which in turn leads to longer vehicle life, reduced risk of fire, and cleaner vehicles for inspection and maintenance crews. Other benefits are elimination of air pollution in the cleaning building, better utilization of the facility and manpower, and greatly improved conditions for cleaning personnel.

Published by: Transportation Control Technology and Systems Office, Oct. 1988, 67 pp.

TCT-89-01 **WIDE AREA VEHICLE MONITORING (WAVM) SYSTEM DEVELOPMENT IN ONTARIO AND THE EMERGING WORLDWIDE COMPETITION**
Author: J. Tsai

WAVM is an application of satellite communications and navigation technologies. The system will provide real-time truck location and identification information, and two-way message communication services between equipped trucks and trucking company base stations. This report describes WAVM development and application in Ontario and reviews the emerging worldwide competition in the WAVM technology and market.

Published by: Transportation Control Technology and Systems Office, Oct. 1989, 20 pp.

TCT-91-01 **"INFORMATICS" – VEHICLE LOCATION, COMMUNICATIONS, CONTROL, AND MONITORING SYSTEMS UNDER DEVELOPMENT IN ONTARIO**
Author: Gabriel Heti

This paper provides an overview of the communications, location, and control technologies being employed to make mobile vehicle monitoring and information transmission systems a reality. Following a review of technologies, current Ministry of Transportation projects in the areas of Automatic Vehicle Location and Control, and Intelligent Vehicle/Highway Systems are described.

Published by: Transportation Control Technology and Systems Office, May 1991, 14 pp.

TRAFFIC AND DECISIONS SYSTEMS

TDS-90-01

AN OVERVIEW OF AVAILABLE AND DEVELOPING HIGHWAY VEHICLE ELECTRONIC TECHNOLOGIES

Authors: Jouko A. Parviainen and Associates

The forerunner to this project, the Mobile Information Systems Impact Study (TDS-88-07), presented a state-of-the-art review of devices that can display a vehicle's position relative to a map data base and that support navigation or route guidance functions. This Highway Vehicle Electronics project was initiated to review the complementary technologies of automatic fleet monitoring, vehicular monitoring/control and travel support systems, and to present a brief update on navigation systems

This report provides a technology primer on highway vehicle electronic systems and their applications. It highlights the need for an integrated intellignet system, and recommends that all systems intended to support navigation, manoeuvring, and control tasks receive a full human factors evaluation.

Published by: Traffic and Decisions Systems Office, October 1990, approx. 230 pp.

Other reports covering research and development in the traffic and decision systems area are available from the Research and Development Branch. They may be obtained by contacting: The Editor, Technical Publications (R&D Branch), Room 320, Central Building, 1201 Wilson Avenue, Downsview, Ontario, Canada M3M 1J8. Telephone: (416) 235-3480.

TRANSPORTATION ENERGY MANAGEMENT

TEMP **TEMP: TRANSPORTATION ENERGY MANAGEMENT PROGRAM AIMED AT
REDUCING THE OIL DEPENDENCE OF ONTARIO TRANSPORTATION – PHASE I:
REVIEW OF OPPORTUNITIES**
Authors: K. Sharratt, V. Soots

This report presents the background to the Transportation Energy Management Program (TEMP), reviews the energy problem, defines the transportation energy problem, and discusses the approaches available for addressing the transportation problem. Also presented is a summary of all TEMP projects which were carried out during the period June 1977 to June 1978 (TEMP Phase I). These include investigation of the feasibility of measures to reduce oil dependency, the inauguration of demonstrations, establishment of conservation goals, and the appraisal of strategies for achieving the goals. Future activities are also discussed. Also included are summary reports for each of the 21 projects undertaken during Phase I of TEMP.
Published by: Systems Research and Development, September 1979, 146 pp.
Participating Agency: Ministry of Energy

TEMP **TRANSPORTATION ENERGY DATA REPORT – VOLUME 1**

This report presents information on net fuel consumption, fuel consumption for trucks, fuel consumption vs. fuel efficiency, traffic volumes, new automobile registrations, weight class distributions, urban transit passengers, and leaded fuel prices for certain time periods.
Published by: TEMP, March 1982, 14 pp.
Participating Agency: Ministry of Energy

TEMP **TRANSPORTATION ENERGY DATA REPORT – VOLUME 2**

Section 1 provides information on transportation energy use and supply, and Section 2 presents data on highway modes such as automobile and truck transportation, urban transit, and motorcycles.
Published by: TEMP, May 1983, 87 pp.
Participating Agency: Ministry of Energy

TEMP **TRANSPORTATION ENERGY DATA REPORT – VOLUME 3**

Some additions contained in this edition include information on fuel consumption by transportation mode and operating costs for trucks, mopeds, propane and propane-powered vehicles.
Published by: TEMP, September 1984, 105 pp.
Participating Agency: Ministry of Energy

TEMP-85-03 **TRANSPORTATION ENERGY DATA REPORT – VOLUME 4**
Prepared by: N. Woinoski

The transportation energy reports monitor current trends in transportation energy demands, ascertain relationships between various transportation energy variables, and provide a forum for presentation in graphical tabular form. Some additions contained in this edition include information on propane fuel costs and natural gas conversion grants.

Published by: TEMP, September 1985, 80 pp.
Participating Agency: Ministry of Energy

TEMP **VEHICLE SPEEDS AND FUEL CONSERVATION SURVEY: OCTOBER 1982**
Authors: J. Bylok, P. Salerno

The Ontario government reduced speed limits on most highways in February 1976. The 1982 Speeds Analysis and Fuel Conservation Survey analyzed traffic flow variables and average speed at 79 sites and compared these parameters with May 1977 data. The study findings provide information on speed increase, the percentage of compliant drivers, and the pace range in both highway and city driving situations. The study then presents information on the impact of fuel consumption.

Published by: TEMP, August 1983, 95 pp.
Participating Agency: Ministry of Energy

TEMP **TEMP YEAR-END REPORT: FISCAL YEAR 1983/84**

This report categorizes and details the projects that were initiated, maintained, and completed in the past year. Projects include Drive\$ave, Trucksave, municipal program, Share-A-Ride, government programs, teleconferencing, alternative transportation fuels marketing and data analysis, and program planning.

Published by: July 1984, 84 pp.
Participating Agency: Ministry of Energy

TEMP-85-01 **TEMP YEAR-END REPORT PART 1: CONSERVATION AND MARKETING FISCAL YEAR 1984/85**
Author: V. Soots

In the past fiscal year, TEMP was re-organized into two separate sections: Conservation and Marketing (administered by the Transportation Energy Office), and Alternative Transportation Fuels (administered by the Automotive Technology and Systems Office). The Conservation and Marketing section continued to promote energy conservation and use of available alternative fuels in both the private and public sectors. The report details the 33 projects carried out in several subprograms, namely, Share-A-Ride, Trucksave, Drive\$ave, government programs, alternative transportation fuels, teleconferencing, and data analysis.

Published by: TEMP, November 1985, 64 pp.
Participating Agency: Ministry of Energy

TEMP-85-02

**TEMP YEAR-END REPORT PART 2: ALTERNATIVE TRANSPORTATION FUELS
FISCAL YEAR 1984/85**

Authors: O. Colavincenzo, V. Soots

During fiscal year 1984/85, the Alternative Transportation Fuels (ATF) program included 28 projects. Five alternative fuels were considered: propane, natural gas, methanol, ethanol, and hydrogen. Major demonstrations have been conducted in methanol blends, neat methanol, propane, and natural gas. Research investigations have been made into vehicle natural gas storage techniques and methanol combustion processes. Technology development has included propane carburetor testing, natural gas compressor investigation, and heavy-duty propane engine development. Central to the ATF program for the past year has been a strong interest in using alternative fuels in heavy-duty engines, for both transit and truck transport applications. This report outlines those projects.

Published by: Automotive Technology and Systems, TEMP, November 1985, 31 pp.

TEMP-86-01

VEHICLE SPEEDS AND FUEL CONSUMPTION SURVEY

Authors: J. Bylok, V. Soots

The 1984 Vehicle Speeds and Fuel Consumption Survey was concerned with analyzing October 1984 average vehicle speed and traffic flow variables on the highways of Ontario and comparing these parameters with October 1978, 1979, 1980, 1981, and 1982 data. The study was also concerned with estimating vehicle fuel consumption on Ontario highways for the survey years and determining if any significant changes (increases/decreases) in vehicle fuel consumption had occurred during this period. A total of 72 highway sites were sampled throughout Ontario. The sites were grouped into three speed limit categories, three traffic volume categories, and five highway type categories.

Published by: TEMP, January 1986, 87 pp.

Participating Agency: Ministry of Energy, StatistiSEARCH

TEMP-86-02

**TEMP YEAR-END REPORT PART 1: CONSERVATION AND MARKETING FISCAL
YEAR 1985/1986**

Author: V. Soots

The Transportation Energy Management Program (TEMP), a joint MTO-MENY program aimed at reducing Ontario's oil consumption in the transportation sector, has operated over the past fiscal year in two sections: Conservation and Marketing, administered by the Transportation Energy Office; and Alternative Transportation Fuels (ATF), administered by the Automotive Technology Office. The Conservation and Marketing section continued to promote energy conservation and the use of available alternative fuels in both the private and public sectors. This report deals with the activities carried out in the five subprograms and the 35 projects.

Published by: TEMP, November 1986, 45 pp.

TEMP-86-04 **TEMP YEAR-END REPORT PART 2: ALTERNATIVE TRANSPORTATION FUELS
FISCAL YEAR 1985/1986**
Author: O. Colavincenzo

The 1985-86 ATF program consisted of 23 projects which were classified under the headings of propane, natural gas, alcohol fuels, diesel substitution, and fuels research. These projects were co-ordinated with the Energy Technology Development and Energy Technology Research sections of the Ministry of Energy. This report deals with specific projects on a general level. Individual project reports and papers should be reviewed for the full details of project descriptions and results.
Published by: TEMP, November 1986, 26 pp.

TEMP-87-01 **TEMP YEAR-END REPORT PART 1: CONSERVATION AND MARKETING FISCAL
YEAR 1986/1987**
Author: V. Soots

The Transportation Energy Management Program (TEMP), a joint MTO-MENY program aimed at reducing Ontario's oil consumption in the transportation sector, has operated over the past fiscal year in two sections: Conservation and Marketing, administered by the Transportation Energy Office; and Alternative Transportation Fuels (ATF), administered by the Automotive Technology Office. The Conservation and Marketing section continued to promote energy conservation and the use of available alternative fuels in both the private and public sectors. This report deals with the activities carried out in the five subprograms and the 33 projects.
Published by: Transportation Energy Office, September 1987, 42 pp.

TEMP-87-02 **TEMP YEAR-END REPORT PART 2: ALTERNATIVE TRANSPORTATION FUELS
FISCAL YEAR 1986/1987**
Author: O. Colavincenzo

The 1986-87 ATF program consisted of 19 projects which were classified under the headings of propane, natural gas, alcohol fuels, diesel substitution, and fuels research. These projects were co-ordinated with the Energy Technology Development and Energy Technology Research sections of the Ministry of Energy. This report deals with specific projects on a general level. Individual project reports and papers should be reviewed for the full details of project descriptions and results.
Published by: TEMP, December 1987, 27 pp.

TTE-85-02

TT&E: AN OVERVIEW

Author: A.G. Stermac, Director

The Transportation Technology and Energy (TT&E) Branch is primarily a research, development, and demonstration unit focussing on the areas of transportation technology and energy that will lead to new and improved products and services for Ontario's transportation systems. The branch provides the ministry with a good knowledge and understanding of the state of the art of pertinent technologies and systems. This report outlines TT&E's mandate and roles, resources, modus operandi, accomplishments, current activities, and future directions.

Published by: Executive Office, July 1985, reprinted November 1985, 15 pp.

TTE-86-01

POSITIONS AND PROSPECTS 1986

Author: A.G. Stermac, Director

The Transportation Technology and Energy (TT&E) Branch has the following mandate: to conduct and promote research, development, and applications of transportation and energy technologies and systems that improve the efficiency and effectiveness of Ontario transportation systems, support the transportation industry, and foster economic growth. The activities of TT&E are directed toward rail and bus technology systems, information and management systems, heavy commercial vehicle technology, transportation energy conservation, and alternative transportation fuels. This report discusses TT&E's present and future position, and outlines the branch's achievements and strategies.

Published by: Executive Office, October 1986, 12 pp.

TT&E

MINISTRY OF TRANSPORTATION – SHARING THE CHALLENGE

This colour brochure introduces the ministry in the context of its responsibilities, expertise, and activities in the areas of highway construction, maintenance, traffic management, transit, and research and development. Published by the Transportation Industry Office, its intended audience is industry and other government agencies in Ontario's transportation sector, where there is potential for co-operation between industry and government in the development and marketing of transportation products and services.

Published by: Transportation Industry Office, September 1987, 18 pp.

TT&E

BRANCH BROCHURE

This eight-page, colour booklet is an introduction to the branch, showing its structure, objectives, and major activities.

Published by: TT&E Branch, March 1990, 8 pp.

TTE-90-01

TRANSPORTATION TECHNOLOGY PERSPECTIVES: THE 1990s AND BEYOND

On March 7th, 1990, TT&E Branch conducted a symposium, "Transportation Technology Perspectives: The 1990s and Beyond," which highlighted the challenges facing transportation in the 1990s. This is a publication of the papers that were presented and transcripts of the proceedings.

Published by: TT&E Branch, May 1990, 163 pp.

TTE-90-03

MANDATE, OBJECTIVES, AND NETWORKING CONTACTS

The Transportation Technology and Energy (TT&E) Branch is comprised of several offices, namely, Vehicle Technology Office, Rail and Advanced Transportation Systems Office, Transportation Energy and Productivity Office, Transportation Control Technology and Systems Office, and Administration and Technical Publishing. This report specifies the mandates, objectives, and networking contacts for each office.

Published by: Executive Office, June 1990, 65 pp.

TT&E

TT&E FACT SHEETS

This package of loose pages includes descriptions of each of the six offices and the service section of the branch. There are 48 sheets describing all of the branch's ongoing and recently completed projects.

Published by: TT&E Branch, November 1990

TTE-91-02

PUBLICATIONS CATALOGUE

The catalogue is a current listing of publications produced by TT&E Branch. Entries for publications since 1980 are accompanied by abstracts. The catalogue also lists videos produced by the branch. Indexed.

Published by: TT&E Branch, July 1991, 72 pp.

TEMP

TRUCK COOL-DOWN AND COLD-STARTING TEST PROGRAM

One means of conserving fuel in heavy-duty truck service is to reduce the practice of idling vehicles during stops in cold weather operation. In this regard, Trucksave conducted a cool-down and cold-starting test program on a heavy-duty truck. The purpose was to establish the cool-down rate of a vehicle when parked hot, at a low ambient temperature, and to determine at which point during the cool-down the vehicle would reach a fail-to-start condition. The program was conducted over a ten-day period in February of 1982. The ambient temperature ranged from +1°C to -39°C. This report documents details of the test, analysis and discussion of the results, and the conclusions drawn.

Published by: TEMP, June 1983, 50 pp.

Participating Agencies: Kaptest Engineering Limited, Ministry of Energy

TKS-83-01

MAINTAINING VEHICLE FUEL EFFICIENCY

Author: I.W. Shepherd

This report presents a number of steps that a commercial vehicle fleet owner or owner-operator can take, particularly in the field of maintenance, to minimize fuel costs and other expenses while improving vehicle availability and reliability. Chapters in the report focus on the role of management and the driver, the importance of records, and minimizing rolling resistance and aerodynamic drag.

Published by: TEMP, September 1983, 75 pp.

Participating Agency: Ministry of Energy

TEMP

FUEL-SAVING TECHNIQUES FOR STRAIGHT TRUCK FLEETS

This series of booklets is designed to assist fleet managers in improving their fleets' fuel economy and productivity. Topics covered are: 1) Keep On Trackin'; 2) Getting More From Your Drivers; 3) Getting the Most Out of Your Trucks; 4) Maintenance Pays; and 5) How to Spec Your Truck.

Published by: TEMP, December 1985

Participating Agency: Ministry of Energy

TEMP

SPEC'ING A FUEL-EFFICIENT TRUCK

Trucksave has produced a series of eight booklets on all aspects of spec'ing a fuel-efficient truck. They show the importance of trip planning, proper maintenance, record keeping and good driving habits. These materials are especially useful to owner-operators and to fleet managers. Topics covered are: 1) Planning a Truck Purchase; 2) Power Plants; 3) Drive Trains and Suspensions; 4) Wheels and Tires; 5) Fuel-Saving Components and Accessories; 6) Typical Specifications; 7) Improving the Fuel Economy of Present Trucks; and 8) The Payoff: Costs Versus Benefits.

Published by: TEMP, March 1982, revised August 1986

TRUCKSAVE – TRUCKING FOR PROFIT FORUM PRESENTATIONS

On June 21st, 1988, Trucksave hosted a forum called "Trucking for Profit" in Toronto. This document contains the proceedings of that forum.
Published by: TEMP, August, 1988, 49 pp.

More information on the Trucksave Program is available by contacting the Transportation Energy and Productivity Office (TEPO). A catalogue of its publications on transportation energy conservation opportunities is available, free of charge, on request.

TEPO
Central Building, Room 324
Ministry of Transportation
1201 Wilson Avenue
Downsview, Ontario
Canada M3M 1J8
(416) 235-5037

VIDEOS

Cold In-Place Recycling

An overview of one in-situ recycling technique suitable for rehabilitating asphalt pavements.
6 minutes, 1991

Hot In-Place Recycling

An overview of two in-situ recycling techniques for rehabilitating asphalt pavements.
7 minutes, 1991

The Pre-trip Inspection Requirements in Ontario for Trucks with Air Brakes

This video is directed at the pre-trip inspection of a single-axle tractor and dual-axle trailer with air brakes. It is in three sections: the regulations, the inspection, and the exemptions.
26 minutes, 1991

Highway 126 Concrete Pavement Rehabilitation

This video describes two methods used to rehabilitate an aging concrete pavement.
9 minutes, 1990

Working in Winter - Pros Do It Right

This is a series of training videos on winter control operations. The three main topics – plowing, sand and salt spreading, and sidewalk maintenance – can be viewed separately. The video also covers fall preparation, various types of equipment, correct operational procedures and what to do on return to the yard. The video will be especially beneficial to maintenance operators. (Available for a three-week loan.) 1990

Check It, You Rely on It

This short slide presentation on video explains in detail the routine every fleet driver should follow at the beginning of every shift. It includes the pre-trip "walk around" to check for such items as fluid leaks or body damage. Also covered is the "fuel stop," which explains the simple checks that should be carried out every time your tank is filled.
20 minutes, 1990

Living with Cars

This video reminds the professional truck driver how to share the road with four-wheelers. It gives tips on how truckers can make the road safer for everyone, by learning to live with cars.
11 Minutes, 1990

D409 and the Scooter: An Exploratory Test

This video describes a test programme that examined the standards for motorized wheelchair tie-down mechanisms while being transported in buses and vans.
9 minutes, 1989

Aggregate Truck Load Shift Experiment

This video describes an experiment to determine the amount of load shift in trucks carrying aggregates.
9 minutes, 1989

Pavement Condition Evaluation: What? Why? How?

This video describes the method used by the ministry to do pavement condition ratings. A copy of the script is included, which can be used as a pocket reference is included.
12 minutes, 1989

All in a Day's Work

This video is geared toward pickup and delivery operations. It explains torque control, progressive shifting, road management, and idling control. It shows how to operate a truck safely, economically, and efficiently in an urban environment.

32 minutes, 1989

Living with Trucks

This informative video explains the do's and don't's car drivers should follow so they can safely share the road with large trucks. The topics covered include stopping distance, safe passing techniques, truck turning space, and cutting in front of a truck.

8.5 minutes, 1988

Stability of Heavy Trucks

This video examines the types of loss of control associated with articulated vehicles – semis, A-trains, and B-trains. The Dynamics of jackknife and trailer swing are discussed.

14 minutes, 1987

Transverse Cracking: Pavement's Perennial Problem

The cracking of flexible pavements is discussed: lipping, cupping, water intrusion, etc. The rout and seal process used by the ministry as a preventative maintenance to extend the life of cracked pavements is also described.

11 minutes, 1987

Vehicle Weights and Dimensions Study

Summary of several years of testing by MTO of the stability characteristics of vehicle combinations of the type used in commercial trucking in Ontario. The reasons for loss of control are examined together with the factors which contribute to rollover, trailer swing, and jack-knife. Comparisons are made between A-train and B-train configurations and their performance under different conditions.

27 minutes, 1986

The Drive\$ave Zone

In this lighthearted video, Ebenezer Scrooge makes a comeback as an energy economizer in a futuristic car lab, where he shows a young couple how correct driving habits and routine car care can help them save fuel and money.

23 minutes, 1983

The Trucksave Edge

This video shows "there's more to moving goods down the road than jamming on the throttle!" It drives home five key fuel-saving points for truck drivers: speed control, road management, proper use of torque, progressive shifting, and elimination of unnecessary idling.

22 minutes, 1983

Planning Smarter, Driving Smoother

This video provides municipal vehicle operators with information and tips on how every driver can save fuel by efficient driving techniques.

26 minutes, 1983

Proper Loading and Axle Weights of Aggregate Carriers

This video has three sections: "know how to load," "know your lift axle," and "know your axle weights." A joint project of TT&E's Drive\$ave/Trucksave Program and the Compliance Branch of the ministry, this video is aimed at the aggregate carrier industry.

These videos are available, free of charge, for a two-week loan period. Write to the MTO Audio Visual Library, First Floor West Tower, 1201 Wilson Avenue, Downsview, Ontario, M3M 1J8, or call (416) 235-3902.

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